



FRIDAY, JUNE 14.

CONTENTS.

ILLUSTRATIONS:	PAGE.		PAGE.
Double-end Saddle Tank Locomotive.....	386	EDITORIAL NOTES.....	392, 394
Pump Fire Extinguisher—Pennsylvania Railroad.....	387	NEW PUBLICATIONS.....	395
The Wuerpel & Taussig Automatic Frog.....	388	GENERAL RAILROAD NEWS:	
Coal Handling Barge of the United States Transportation Co.....	389	Meetings and Announcements.....	398
Diagrams from the Tests of the S. S. "Meteor".....	389	Personal.....	399
The Jewett Metal Truck.....	390	Elections and Appointments.....	398
		Old and New Roads.....	399
		Traffic.....	400
CONTRIBUTIONS:		MISCELLANEOUS:	
Refrigerators on the Monon Route.....	385	Technical.....	397
Brake Shoes.....	385	The Scrap Heap.....	391
The Value of Distant Signals.....	385	Conti's Laws of Sliding Friction.....	385
EDITORIALS:		The Railroads of the World.....	385
Automatic Couplers and Continuous Brakes.....	392	Rail Sections in Germany.....	387
The American Society of Civil Engineers on Rail Sections.....	393	Hydraulic Service at Frankfurt-on-the-Main.....	387
Ambiguity in Train Orders.....	393	The Brazos Deep Water Harbor.....	388
English Train Accidents.....	394	Tests of Marine Engines at Sea.....	388
The Conemaugh Dam.....	394	Moving Turn-Tables by Compressed Air.....	391
		Train Accidents in England.....	396

Contributions.

Refrigerators on the Monon Route.

CHICAGO, June 10, 1889.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of June 7, you say, on page 380, in the Car Notes: "The Louisville, New Albany & Chicago is building 100 refrigerator cars, the first the company has ever had" [owned]. This company has had 100 of the Tiffany cars in service for two or three years, and the number now being built is 200, and they have the Bossman patent tanks illustrated in your paper Aug. 31, 1888.

CHAS. F. PIERCE,
Manager Tiffany Refrigerator Car Company.

Brake Shoes.

TO THE EDITOR OF THE RAILROAD GAZETTE:

You lately called attention to the complicated nature of brake shoe service and the difficulty of getting any ideally best material for brake shoes. I wish to contribute a few figures taken from records of actual service. They are average figures taken from 300 locomotives, and show the mileage made per $\frac{3}{32}$ inch wear of tire. The two sets of averages are drawn from engines in different classes of service.

(1.)	Miles per $\frac{3}{32}$ wear.
Without steel flange shoes.....	2,400
With Ross steel shoes.....	5,709

(2.)	Miles per $\frac{3}{32}$ wear.
Without steel flange shoes.....	4,900
With Ross steel shoes.....	10,450

Some results shown with the Ross shoe have given 14,000 miles per $\frac{3}{32}$ in wear, not as the maximum but as the average of several good results.

BRAKE SHOE.

The Value of Distant Signals.

74 WALL STREET, New York, June 7, 1889.

THE EDITOR OF THE RAILROAD GAZETTE:

Appropos of recent discussions of block signaling in your paper, how does it happen that the Pennsylvania Railroad in its block signals omits such a very important adjunct as the distant signal? It seems to me that your remarks are eminently sound as to the stultification of the system effected by adding starting and advance signals at ordinary line cabins. The true inwardness of block signaling seems to lie in having a signal which shall show at the beginning of a stretch of road whether that piece of road is clear of trains. A train should not pass this signal until it is set at safety. This train may, in a fog, proceed only 100 yards beyond the signal and then come to a stop without the knowledge of the signalman. If, then, another train approaches in the block behind, which has been "cleared," and the fog prevents the runner of the train from seeing the signal until close upon it, he is liable to run past it before he can stop, and may collide with the standing train in the block ahead. As the chief utility of the block signal, where trains are provided with the perfect appliances of the present time for stopping, is to maintain high speed in spite of fog, the omission of the distant signal to give warning that the end of the block is close by seems to nullify its chief intention.

Conti's Laws of Sliding Friction.

BY PROF. MANSFIELD MERRIMAN, LEHIGH UNIVERSITY.

It is now well known that the laws of friction, as stated in the text-books on mechanics, and which were deduced by Morin about 1830, are but rough approximations. The force of friction between two surfaces, sliding relatively to each other, is now known to vary both with the velocity and with the intensity of the normal pressure, although there are differences of opinion as to the laws that govern this variation. The experiments on record are indeed scarcely sufficient to enable laws to be stated that will apply to considerable ranges of velocity and pressure.

The object of this article is to call attention to the extensive series of experiments made in 1874 by Peter Conti

Colonel in the Italian corps of engineers, and published in 1875 in the *Atti della Reale Accademia dei Lincei*, and to the conclusions as deduced by him therefrom. These experiments appear to be quite unknown to American engineers, but they well deserve attention, not only on account of their great number and the variety of materials employed, but also on account of the precise and careful manner in which they were executed and discussed.

The apparatus used by Col. Conti was an inclined plane, four metres in length, which could be set at any angle with the horizontal and thus different velocities of the sliding object be obtained. Upon the sliding surface was a box that could be weighted so as to give varying pressures. The velocity was measured by an ingenious electric device which, by completing a circuit at every tenth of a second, recorded upon a strip of paper the position of a certain point in the sliding surface.

The co-efficient of friction was computed by determining the force F parallel to the plane and dividing it by the normal pressure. To find F the component of the weight parallel to the plane was diminished by the force expended in accelerating the sliding body and by the force required to overcome the resistance of the air. Or, in the form of an equation,

$$W \sin \theta - W \frac{v}{g} - S = f W \cos \theta$$

in which f is the co-efficient of friction, W the weight of the sliding surface with its loaded box, θ the angle of inclination of the plane, v the acceleration of the body, g the acceleration of gravity, and S the resistance of the air. To determine S a formula deduced by Morin was used.

The numerical results of the work occupy 170 quarto pages of Col. Conti's memoir, and they are accompanied by numerous plates representing the final conclusions by means of curves on cross-section paper. The velocities are given in metres per second, and the pressures in kilograms per square metre. These units will be used in the following brief synopsis of some of the results. All of the experiments are on the sliding friction of bodies in motion, with velocities greater than 0.2 metres (0.656 ft.) per second, while the highest velocities were about 3.5 metres (about 11.5 ft.) per second. The pressures were low, ranging for metals from 10,000 to 80,000 kilograms per square metre (14 to 112 lbs. per sq. in.).

By a discussion of all the experiments Conti deduces the three following laws of sliding friction:

1. The co-efficient of friction increases as the pressure per square metre decreases, and this increase is greater with lubricated surfaces than with dry surfaces.
2. The co-efficient of friction increases with the velocity, reaching a maximum at speeds of from one to two metres per second, and then decreases with the velocity.
3. The greater the pressure per square metre the less is the difference between the maximum co-efficient and those which occur at lower and higher velocities.

It should be borne in mind that the first of these laws has no reference to the friction of rest, that is, to the force of friction required to start a body, but is stated for cases where the velocity is greater than 0.2 or 0.3 metres per second. The following numerical values will serve to illustrate the laws.

For lubricated surfaces of cast iron upon cast iron, with a pressure of 15,000 kilograms per square metre, the values of the co-efficient f for different velocities were,

for $v = 0.6$, $f = 0.050$,	1.0, 0.079,	1.4, 0.120,	1.8, 0.122;
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with 20,000 kilograms per square metre they were,

for $v = 0.6$, $f = 0.044$,	1.0, 0.066,	1.4, 0.092,	1.8, 0.101;
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and with 30,000 kilograms per square metre,

for $v = 0.6$, $f = 0.039$,	1.0, 0.056,	1.4, 0.075,	1.8, 0.080.
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These figures illustrate the first and third laws very well, but do not show the decrease from a maximum as stated in the second. By plotting curves corresponding to these values it will be seen, however, that a maximum is indicated at about 1.8 or 2.0 metres per second. The following values of the co-efficient f for dry surfaces of cast iron upon cast iron give the maximum at the lower speed of about 1.4 metres per second; thus when the pressure is 10,000 kilograms per square metre Conti found,

for $v = 0.6$, $f = 0.154$,	1.0, 0.165,	1.4, 0.172,	1.8, 0.157	2.2, 0.150;
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and with 30,000 kilograms per square metre,

$f = 0.150$,	0.157,	0.164,	0.153,	0.144
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It would be easy to quote from Conti's memoir many other experiments indicating the essential correctness of the laws as enunciated. The materials employed were steel, brass, copper, leather, rubber, and various kinds of timber, all sliding upon cast iron, the surfaces being both dry and lubricated, and in all cases it was found that the co-efficient of friction decreased with the pressure and varied with the velocity, as stated in the three laws.

Conti's first law of friction is one that was affirmed by some of the older experimenters, until the authoritative edict of Morin made the co-efficient independent of the pressure. Thus Vince, in 1785, says: "The quantity of friction increases in a less ratio than the weight of the body," and again "the smallest surface has always the least friction." The following is one of his experiments whereby this was proved: "A body was taken whose flat surface was to its side as 22 to 9, and with the same moving force the body described on its flat side $33\frac{1}{2}$ in. in two seconds, and on its edge 47 in. in the same time."

The second and third of Conti's laws, as well as the first,

will be recognized as applicable to many of the experimental results deduced during the past fifteen years by Kimball, Thurston, Woodbury and others. How they will apply to cases where the pressure is heavy and the velocity high we cannot well judge, and it is greatly to be desired that experiments should be made to cover such conditions.

The Railroads of the World.

The following figures are taken from the *Archiv für Eisenbahnwesen* for May-June, 1889. As the annual statements in that journal are quoted as a statistical authority, we reproduce the original figures in kilometres, adding, for convenience, the approximate equivalent in miles, reduced on the basis of 1.6 to 1. The mileage figures are for the date of Dec. 31, 1887.

	Length of Line, Kilometres.	Approximate equivalent in miles.	Per cent. increase in four years.
Germany.....	39,785	24,900	10.6
Austria and Hungary.....	24,432	15,300	18.6
Great Britain and Ireland.....	31,521	19,700	4.8
France.....	31,208	21,400	15.2
Russia.....	28,517	17,800	13.5
Italy.....	11,759	7,300	24.4
Belgium.....	4,700	2,900	10.2
Netherlands.....	2,957	1,800	17.3
Switzerland.....	2,919	1,800	2.6
Spain.....	9,309	5,800	12.8
Portugal.....	1,804	1,100	20.9
Denmark.....	1,965	1,200	9.1
Norway.....	1,502	1,000	0.8
Sweden.....	7,579	4,600	15.3
Servia.....	517	320	*
Roumania.....	2,405	1,500	60.3
Greece.....	613	380	*
Turkey, etc.....	1,394	900	0
Total Europe.....	207,806	129,900	13.6
United States.....	241,210	150,700	26.1
British America.....	19,883	12,400	41.6
Mexico.....	6,562	4,100	35.6
Central America.....	800	500	60.0
U. S. Colombia.....	265	160	0
Cuba.....	1,600	1,000	0
Venezuela.....	293	180	129.7
Hayti.....	80	50	0
Porto Rico.....	11	7	0
Brazil.....	7,929	5,000	55.5
Argentine Republic.....	6,446	4,000	81.2
Paraguay.....	72	45	0
Uruguay.....	556	350	18.3
Chili.....	2,838	1,800	57.7
Peru.....	1,347	800	2.9
Bolivia.....	70	45	25.0
Ecuador.....	151	90	118.9
British Guiana.....	35	22	0
Total America.....	290,155	181,300	28.8
British India.....	22,665	14,200	36.1
Ceylon.....	289	180	11.2
Asia Minor.....	598	370	60.8
Asiatic Russia.....	1,277	800	5.5
Dutch Possessions.....	1,100	700	147.0
Japan.....	736	460	*
Malay States.....	45	28	*
China.....	45	28	*
Cochin China.....	83	52	*
Total Asia.....	26,898	16,800	....
Egypt.....	1,500	900	0
Algeria and Tunis.....	2,480	1,550	39.4
Cape Colony.....	2,795	1,700	43.2
Natal.....	350	220	124.4
Mauritius, etc.....	591	360	136.4
Total Africa.....	7,716	4,800	36.9
New Zealand.....	2,900	1,800	25.4
Victoria.....	3,085	1,900	28.5
New South Wales.....	3,276	2,000	54.1
South Australia.....	2,349	1,500	56.0
Queensland.....	2,700	1,700	63.8
Tasmania.....	700	440	152.7
Western Australia.....	296	180	105.6
Total Australasia.....	15,297	9,500	47.7
Total for the World.....	547,872	342,400	23.6

Figures of capital, on the basis of the latest available estimates, are as follows:

	Date of estimate.	Capital per mile.
I. Europe.		
Germany.....	1888	\$97,000
Austria.....	1886	97,000
Great Britain and Ireland.....	1887	204,000
France.....	1885	127,000
Russia.....	1885	86,000
Italy.....	1884	88,000
Belgium.....	1887	122,000
Switzerland.....	1887	108,000
Spain.....	1884	85,000
Portugal.....	1882	59,000
Denmark.....	1888	40,000
Norway.....	1888	35,000
Sweden.....	1887	29,000
Estimated average for Europe as a whole.....		113,000
II. Non-European countries		
United States.....	1888	60,000
Canada.....	1888	56,000
Brazil.....	1886	50,000
Argentine Republic.....	1886	42,000
British India.....	1886	67,000
Cape Colony.....	1886	42,000
New South Wales.....	1888	62,000
South Australia.....	1887	28,000
Victoria.....	1888	66,000
Queensland.....	1886	31,000
New Zealand.....	1888	36,000
Estimated average for non-European countries.....		50,000

Multiplying these figures by the mileage in and out of Europe, respectively, we have the invested capital of railroads in Europe, amounting in round numbers to \$14,500,000,000, while that of the rest of the world amounts to something over \$12,000,000,000.

The proportion of double track in various countries is given as follows:

	Per cent.		Per cent.
England.....	54.1	Russia.....	13.4
France.....	37.3	Switzerland.....	15.2
Germany.....	28.4	Austria.....	8.4
Belgium.....	28.0	Italy.....	6.8
Holland.....	24.7	British India.....	6.5

* Almost wholly new.

Double End Saddle Tank Locomotive.

The double end saddle tank locomotive, which is illustrated in this issue, was designed and built for exportation to Buenos Ayres, South America. This is known in the South American trade as the "Coast Line" type. The engine shown weighs but 32,000 lbs., but it is a large locomotive of the class to which it belongs. They are built of but 23,000 lbs. weight. An extract is given below from the specifications for this particular engine, a comparison of which, with specifications for ordinary locomotives, will be interesting. The engine was built by Messrs. H. K. Porter & Co., Pittsburgh, Pa. The perspective view is made from a photograph of an engine of the same class, but not the engine shown in the detailed drawings.

General Description.—Gauge of track, 56½ in.; rail, 30 lbs. per yard; fuel, coal or wood; service, passenger, suburban road; tank on boiler; cylinders, 9 in. diameter by 16 in. stroke; driving wheels, 4 in number, 26 in. diameter; truck wheels, 4 in number, 20 in. diameter; rigid wheel base, 5 ft. 9 in.; total wheel-base, 15 ft. 9 in.; weight of engine, in working order, about 32,000 lbs.; 21,500 on driving wheels.

Length over all, front and back bumpers, 21 ft. 7½ in.; length over all, front and back pilots, 28 ft. ¾ in.; height above rails to top of cab, 9 ft. 4 in.; total height over smoke stack, 10 ft. 11 in.; extreme width over cylinder casings, 7 ft. 6 in.; extreme width over cab, 7 ft. 7 in.; general style of engine, "Coast Line."

Boiler.—Boiler throughout of homogeneous cast steel plates. Shell, 5-16 in. thick, except cylindrical sheets 9-32 in. thick, and round head ¾ in. thick. Diameter at front end 32 in., and at back end 37 in., wagon-top style. Dome 21 in. dia., and 23 in. high, with cast ring and cap, lagged and cased. Fire-box, 42 in. long, 27 in. wide at grates, and 27 in. wide at top, inside measurements; crown, sides and door sheets 9-32 in., and flue sheet ½ in. thick; water space 2½ in. at bottom, tapering wider at top. Stay-bolts, 13-16 in. dia., screwed and riveted ¼ in. between centres. Crown-bars of open pattern, welded at ends with bolts screwed and riveted to crown sheet, with ample water space; with bearing on upright sheets and stayed to dome. Flues of iron, lap-welded, 86 in number, 1¼ in. dia., 75 in. long, set with copper ferrules at fire-box. Fire door hole made by flanging and lapping inside and outside sheets. Boiler thoroughly braced and stayed; hand riveted by improved patent process; patent concave caulking with blunt tools on bevelled edges; cleaning holes with brass plugs at front and back of fire-box and in front flue head. Boiler tested before lagging, by hydraulic pressure, to 180 lbs. per square inch; also tested by its own steam at working pressure. Balanced throttle placed in dome. Ground metal ball joints in all steam pipe connections. Ashpan provided with front and back dampers worked from footboard. Rocking grate.

Stack.—With patent noiseless exhaust, with spark arrester and steel wire netting for wood and for coal.

Pump and Injector.—One full stroke pump, with valves and cages of hard composition. One No. 3 injector. Pump and injector each capable of separately supplying sufficient water, regulated from footboard, and with seamless copper pipe connection. Wagon-top part of boiler inside of cab lagged and cased.

Cylinders.—Of hard charcoal mixture of metal; well and accurately secured; placed horizontal; cast with half saddle; reversible. Pistons, solid heads with Porter combined spring ring and steam packing. Rods of steel. Guides of steel, properly secured to cylinders and guide-yoke. Cross heads with babitted bearings.

Valve Motion.—Shifting links of hardened steel graduated to cut off equally at all points of stroke; hardened steel blocks with long flanges. All working joints extra long bearings and fitted with hardened steel pins and thimbles.

Drivers.—Cast-iron centres of strong charcoal mixture of metal; cast steel tires. Forged steel axles. Cast steel crank pins. Springs of cast steel, placed one over each driving-box. Driving-boxes with brasses and cellars, and flanged wedges and shoes.

Rods.—Main and parallel rods of forged steel; forged solid; fitted with taper bolts and full complement of straps, keys and oil cups; brasses babitted.

Frames.—Of forged iron 2 in. wide by 3 in. deep, pedestals lap-welded on; frames well braced. Pedestal braces secured by lugs and bolts. Attachments of boiler to frames, allowing free expansion and contraction. Equalizers of forged iron with steel bearings, placed at sides connecting spring hangers of driving wheels.

Two Trucks (front and rear).—Each truck 2 wheels, 20 in. diam.; axle of forged steel; boxes with cellars and brasses; cast steel springs; centre bearing and swing motion with radial bar; hangers with steel pins and thimbles.

Cab.—Of seasoned hard wood painted, put together with joint bolts, well secured to boiler and runboards; neatly designed and finished.

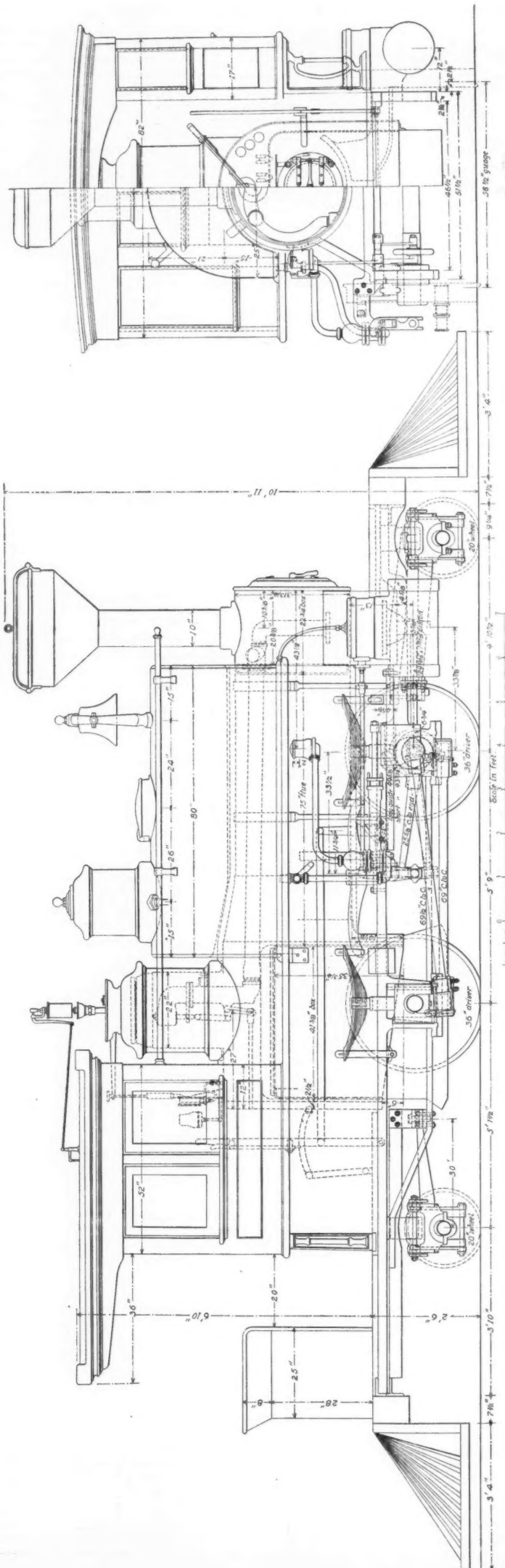
Furniture.—Engine furnished with sand-box, bell, whistle, safety and relief valves; steam gauge, cab lamp, sight-feed cylinder oilers; blow-off, heater, blower, gauge, pet and other cocks; full complement of brass work; extra exhaust nozzles; tool box and cushion; tools, including 2 screw-jacks, tallow can and 2 oil cans; spanner, socket and 6 flat wrenches, fitting all nuts and bolts; 2 monkey-wrenches, steel and copper hammers, 2 chisels, pinch-bar, poker, scraper and torch, gong and water gauge, 2 14-in. headlights, hand brake and steam brake for drivers.

Finish.—Cylinder heads with polished cast-iron casings; steam chests with cast top and body casings painted; boiler and cylinders lagged and cased, with planished securing bands. Wheel covers, hand rails and runboards. Pilot at each end, of seasoned hardwood, iron bound and braced. Engine well and neatly painted and varnished.

Tank of steel, placed over boiler; well supported and secured; neatly finished; capacity, 400 gallons.

Fuel.—Carried in bunker placed at rear end.

General Features.—Engine throughout of best material and workmanship, all parts liable to require renewal are drilled planed, turned and fitted to standard templates and gauges and made interchangeable with all engines of same class. All bolts of U. S. standard thread; all cocks fitted to standard gas taps. All movable nuts and all wearing surfaces of steel or iron case hardened; all wearing brasses of ingot copper and as



DOUBLE-END SADDLE TANK LOCOMOTIVE.

By Messrs. H. K. PORTER & Co., Pittsburgh, Pa.



DOUBLE-END SADDLE TANK LOCOMOTIVE.

large a proportion of tin as can be worked; all cast iron wearing surfaces of hard, close charcoal mixture of metal. To be fired up and worked on friction rollers before shipment.

Pump Fire Extinguisher.

The device shown herewith is a pump fire extinguisher standard on the Pennsylvania Railroad. It differs from the ordinary chemical fire extinguisher, principally for the reason that it can be operated at will and with any degree of force.

It consists of a bucket of indurated fibre, shown in fig. 1, 18 in. high, 10 in. in diameter, and $\frac{5}{8}$ in. thick. This bucket is attached to a light cast-iron bar, shown in fig. 2, by means of five rivets. The cover of the bucket is also made of cast-iron: it is shown in fig. 3. To the extinguisher are attached two handles, as shown at A and B. In the cover is a hand-hole with a cover arranged to be easily removed. The pump is known to the trade as the "Hydrostatic Champion," manufactured by the National Manufacturing Co., Boston. It is inserted through a special opening in the cover of the extinguisher, and the joint around it is made tight by a ground joint similar to that used for brazed joints on copper steam pipes. The pump has a spherical end, and fits into a ball socket at the bottom of the extinguisher. These facts are clearly shown by the illustration.

The method of making tight the various joints is interesting. That between the cover and the bucket is made with a moulded rubber ring inserted into a groove or recess in the cover, as shown in fig. 1. The cover is held firmly upon the rubber ring or gasket by five joint bolts. The joint between the bolt and the cover is closed by a leather gasket placed under the head of the bolt. The joint between the hand hole cover and the cover of the extinguisher is ingeniously made by a piece of round leather belting with the ends scarfed and cemented together. The bevel of the recess in the cover forces the leather to a seat on the cover of the extinguisher and makes a neat and very satisfactory joint. This is all clearly shown in fig. 1.

A small safety valve prevents the accumulation of gases within the extinguisher. Other details of the device are so well illustrated as not to require further description.

There are various advantages claimed for the use of this form of extinguisher; among them may be mentioned the following:

- (1.) Simplicity of construction, there being no valves, cocks or appliances that look mysterious to the uninitiated.
- (2.) Ease of inspection and greater certainty in regard to its condition. A single stroke of the pump tells whether it is in order, and the removal of the cover and a glance at the interior informs the operator if it be charged.
- (3.) Durability. The action of the chemicals is a great source of depreciation. Few metal fire extinguishers exist long without corrosion, and when corroded there arises a danger of bursting in service, both of which are avoided in this extinguisher.
- (4.) Ease and rapidity of recharging. By removing the cover charging can go on while the extinguisher is being used, which is a valuable feature when a single extinguisher full is not enough to put out a fire.
- (5.) No special instructions are required. The sight of the pump fire extinguisher is almost sufficient instruction how to use it.
- (6.) The extinguisher throws a much larger stream than the ordinary chemical one.
- (7.) The fire extinguishing liquid can be used more economically. The ordinary extinguisher must be used continuously until exhausted, when once started. This is not true of the pump extinguisher, and no waste of material occurs if pumping ceases for an interval.
- (8.) The force of the stream can be varied at will. In this respect it differs from the ordinary extinguisher.
- (9.) The cost of this extinguisher is considerably less than those now in use.

There are other advantages incident to this apparatus which will suggest themselves to the reader after an inspection of the cuts. It is not patented. The pump itself is bought in open market. The buckets so far used by the Pennsylvania were made by the Indurated Fibre Company, but they can be made of copper, brass or other durable material.

Rail Sections in Germany.

At a meeting of the Verein für Eisenbahnkunde, in Berlin, Feb. 12 last, the rail sections in use in Germany and America were discussed. For the following notes we are indebted to a recent number of *Glaser's Annalen*:

The discussion was opened by Herr Zimmermann, who

stated that in Germany the rail heads have, without exception, either vertical, or, in many cases, converging (heads narrower at the bottom than at the top) sides. In America, on the contrary, the heads are flaring, wider at the bottom than at the top, the object sought by this form of head being a large bearing for the angle plates. The usual amount of bearing surface under the head with them (i. e., the Germans) appears too small, and in America it is increased by flaring the sides of the rail-head.

Herr Kolle remarked that in the Argentine Republic the American form of rail heads has been adopted. From observations made by him on the spot the behavior of the joints was poor. It must, however, be allowed that the maintenance of the way in general is not of the best.

Herr Stambke said that in case a change in the form of the rails at present in use on the continent should be had in view, not only would the widening of the bearing surfaces for the joint splices according to the American model come into consideration, but above all things the widening of the bearing surface for the wheels, and the increase of the stiffness of the rail section. The rapid hollow wearing of the treads of the wheels, requiring a frequent turning, necessarily calls for increase in the bearing surface. An increase in the depth of the rail head for increasing the durability of the rail he did not consider necessary or effective. When steel came into use the weight of the rails was reduced because of the greater resistance of the steel and of the greater first cost of the material. The stiffness of the rail has, however, suffered

considerably thereby. The new rails spring more from the passage of heavy and rapid trains, and the permanent way is not rigid enough. The ideal for a permanent way is to so construct it that the pressure due to the loads upon it may be distributed over the greatest possible surface of the road-bed. A stiff heavy rail distributes the pressure over a greater number of ties, and consequently a greater surface than a more flexible rail. The ties lying directly under the wheels are, with light rails, heavily loaded, while those lying between the wheels may be subjected to no load at all.

Herr Stambke expressed the opinion that the manner in which a rail section of greater strength is to be formed needs thorough examination—he thinks that if the width of the head be increased so as to preserve its symmetry that there will be difficulties encountered in substituting the new rail on the old lines, owing to the fact that one or both rails may have to be moved outward in order that the gauge may be right, and he considers that this fact may be an obstacle to the substitution of a heavier rail for the standard in use at the present time—this presupposes a retention of the old fittings, chairs, etc. He recommends that the symmetry of the head be sacrificed and the width of the latter be increased toward the outside. He stated that the "Goliath" rail seemed to him to have much merit and that he was convinced that a permanent way constructed with this rail will do well for high speed, and that the greater first cost would be covered by the lowering of the expense for maintenance.

Herr Kinel, while agreeing with Herr Stambke on the necessity or desirability of a heavy solid permanent way for rapid and heavy traffic, gave it as his opinion that in fixing upon a new rail section a greater breadth should be given to the flange of the rail in the interest of stability and the durability of the ties. He was of the opinion that the quality of the steel used of late had degenerated. Herr Goring was also of the opinion that the flange should be broadened as affording greater security against the canting of the rails, and favored the use of inclined chairs in the place of spiking the rails directly to the ties.

Hydraulic Service at Frankfort-on-the-Main.

The hydraulic installation at the main passenger station at Frankfort-on-the-Main, Germany, represents one of the most elaborate applications of hydraulic power that has yet been made in continental Europe.

The engine works are located about three-fifths of a mile from the station, on the banks of the river, and are fitted up with two engines of 750 horse-power each. Each engine

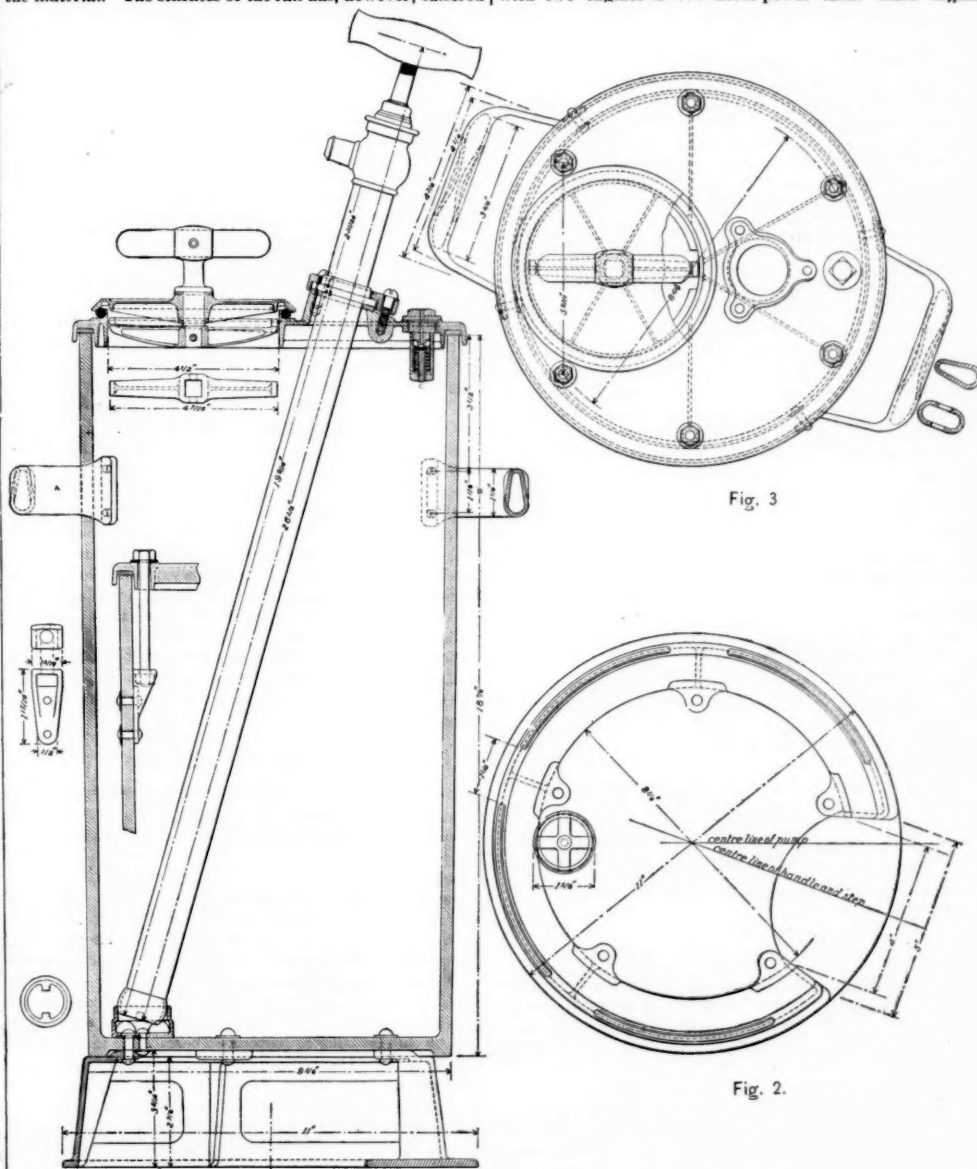


Fig. 1.

PUMP FIRE EXTINGUISHER—PENNSYLVANIA RAILROAD.

Fig. 3.

Fig. 2.

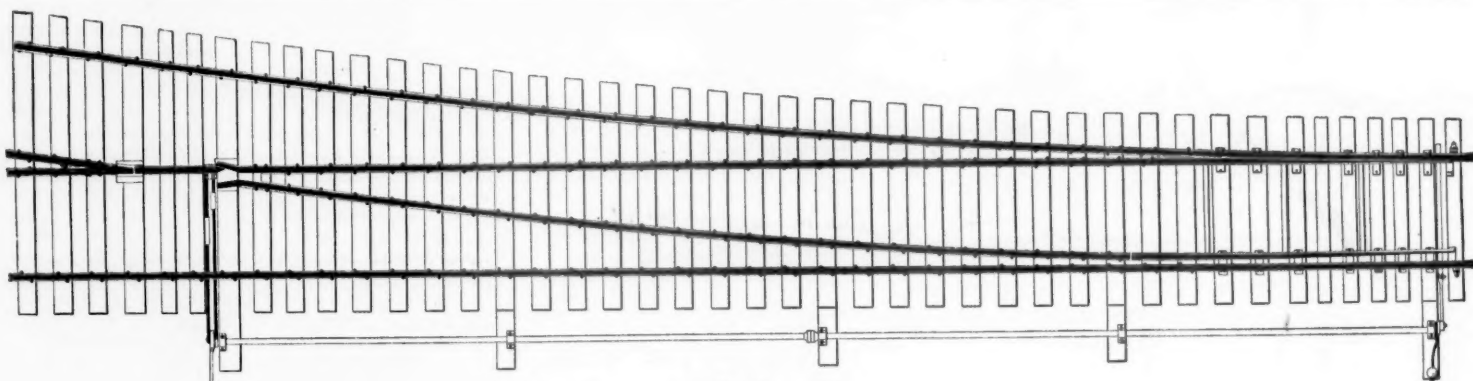


Fig. 1.

THE WUERPEL & TAUSSIG AUTOMATIC FROG.

drives three pumps which supply the water to two accumulators, in which a pressure of 75 atmospheres is maintained. There is, in addition, a water tower about 130 ft. high, with a reservoir having a capacity of 28,200 cu. ft. The water is taken from the river, but before passing to the pumps goes through two filtering operations. The daily consumption of water for high-pressure service amounts to 43,125 cu. ft., and as this water is used under some back pressure in the various hydraulic machines, it still is under sufficient pressure, after having performed its work in these, to be fed directly, without the intervention of pumps, into the boilers which supply the engines. Besides working the various freight elevators the water is used for electric lighting, there being four dynamo stations for this purpose. In two of these two water pressure engines of about 200 horse-power each are employed, while the remaining two have 50 horse-power engines. The electric installations were put down by the well known German firm of electrical engineers, Messrs. Siemens & Halske, while the hydraulic work was in the hands of Mr. C. Hoppe, of Berlin.

The Wuerpel & Taussig Automatic Frog.

The frog which is illustrated here has been in use in the main track to the East St. Louis yards of the St. Louis Bridge & Tunnel Railroad for five years. During this period it has outlived three sets of ordinary frogs in the tracks adjacent, and not a wheel has ever left the track at this frog.

As will be seen from figs. 1 and 2, the frog consists of a short piece of rail, the heel of which is fastened to the main line rail and siding rail by a special form of angle splice, which serves as a pivot, thus allowing the free end of the rail to move laterally an amount sufficient to bring the rail into line with the turnout rail or main rail, as the case may be. The free end of the rail is cut to a bevel. The connection of the movable rail with the oscillating shaft is sufficiently shown in fig. 1, which shows the switch and frog set for the main track. With the switch in this position and a train coming out of the siding, the flange of the first wheel that arrives at the frog pushes the movable rail over toward the turnout rail. The first contact of the wheel and rail acts upon the starting bar (the lower of the two connecting rods shown in the cross section, fig. 3), which carries the main rod off the centre. As soon as the centre is passed the main rod completes the semi-revolution of the oscillating shaft which, by a reciprocating motion at the switch end, throws the points into position for the siding. The same action takes place when the switch is set for the siding and a train is coming out of the main track. Of course, on entering the switch it has to be thrown by hand; but this may be done either at the switch or the frog. In a busy yard this arrangement saves an immense number of steps, for the trainmen, when coming out of the switch, are not obliged to run ahead to throw the switch.

The different frog numbers are obtained by simply varying the length of the movable rail; the lengths varying from 6 ft. 1 in. for a No. 11 frog to 3 ft. 9½ in. for a No. 6 frog.

The cut shows the frog with a "ground throw" switch lever, but it can be fitted with any of the automatic switch stands. One of these frogs, with the Ramapo stand, has been in use at the east end of the East St. Louis yards for nearly three years.

These frogs are simple in construction, require very little attention in the way of repairs or maintenance, and have no guard rails to catch the feet of switchmen.

Fig. 4 is from a photograph showing a switch fitted with this frog, through which a daily average of 1,300 cars passed in 1888, besides a great amount of switching, of which no record was kept.

The Brazos Deep Water Harbor.

We have had occasion in former issues to mention the fact that the work is now going on of constructing a deep water harbor at the Brazos River, in Texas. The work is well under way, and it is expected that it will be so far advanced by the time of high water next winter that the action of the river will scour a channel of at least 25 ft. across the bar. This work is being done by contract for the Brazos River Channel & Dock Co., E. L. Corthell, Chief Engineer, and George Y. Wisner, Resident Engineer. The contractor for the work is Mr. G. Wilke, of Chicago, who undertakes to make and maintain a 20-ft. channel from the deep water in the river to deep water in the gulf, and his payment is conditioned on the success of maintaining this channel.

Some notes concerning the history of this scheme and the physical conditions will be not without interest. The Brazos

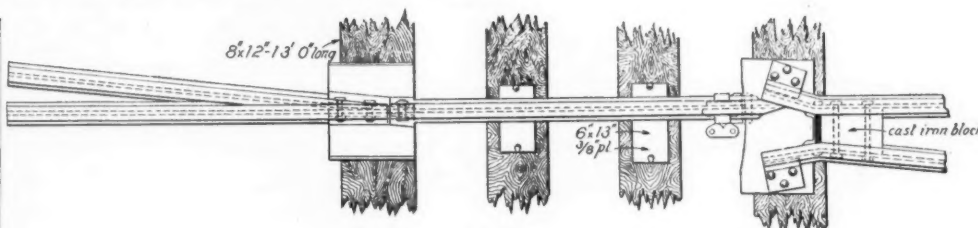


Fig. 2.

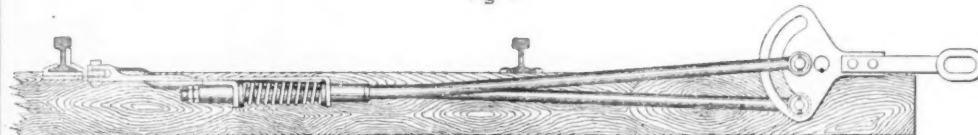


Fig. 3.

River has a drainage area of about 40,000 square miles. It is about 800 miles long, and is a tidal stream for 50 miles from its mouth. For several miles from the gulf it is from 500 to 800 ft. wide, and has a depth varying from 17 ft. to 45 ft. At high water it has a slope of 1 ft. per mile, a mean velocity of 5 miles per hour, and a discharge of 60,000 cu. ft. per second. At low water the discharge is about 1,000 cu. ft. per second, and during nine months of the year it will probably exceed 5,000 cu. ft.

In 1880 Congress appropriated \$40,000 for deepening the channel across the bar; in 1881, \$40,000; in 1882, \$50,000 and in 1884, \$10,000. This money was expended under the direction of the Engineer Bureau of the War Department, and we are informed that it has been almost without results, the greater part of the work having been washed away within a few weeks after it was done. In September, 1887, it was reported by officers of the corps that it would be impracticable to maintain a channel depth of more than 6 ft. over the bar, and appropriations from Congress became impossible. During the winter of 1887-88 a syndicate was formed which purchased land, obtained a state charter and got the necessary Congressional action empowering the company to build and maintain the necessary structures for a deep water channel from the river to the gulf. It is this syndicate with which Mr. Wilke has made the contract mentioned above.

Active construction was begun about April 1, and the trestle work is built out about 1,600 ft. into the gulf and the mattress work about 700 ft. The crest of the bar is about 3,000 ft. from the shore line. The mattresses are built in place, being suspended from the trestle work and lowered in a homogeneous mass as the work proceeds. The channel between jetties is to be 560 ft., and the river channel will be rectified to a uniform width of about 450 ft.

Work on the Brazos & Northern Railroad is being pushed at the same time. The location has now been begun, and it is the expectation of those interested to have trains running to Houston by next fall.

A Coal Elevator Barge.

The coal barge which is shown in the accompanying illustrations is the embodiment of patents owned and operated by the United States Transportation Co. of New York. The coal is transported to the desired points for unloading, and is discharged by endless chain conveyors as shown. In the bottom of the hold run two horizontal conveyors, returning under the deck. At regular intervals are valves to admit coal from the cargo space to these conveyors. These valves are worked by hand wheels from the deck. The coal is allowed to enter the conveyors by any or all of the openings, as desired. It is carried along to near the boiler end of the barge and there dumped into a receptacle, from which it is taken by the elevating conveyors. These latter carry it up to the hoppers, whence it is discharged by telescoping pipes at any point within 50 ft.

The conveyors are driven by a high speed engine, and they may be worked separately or simultaneously, at will, by means of the clutch pinions operated by the four levers shown in the transverse section.

It is claimed that there is little or no breakage of coal by this method of discharging, and that a barge of 600 tons capacity can be unloaded by two men in less than three hours. Another advantage is that a barge does not need to be shifted while its cargo is being discharged. The barge is made

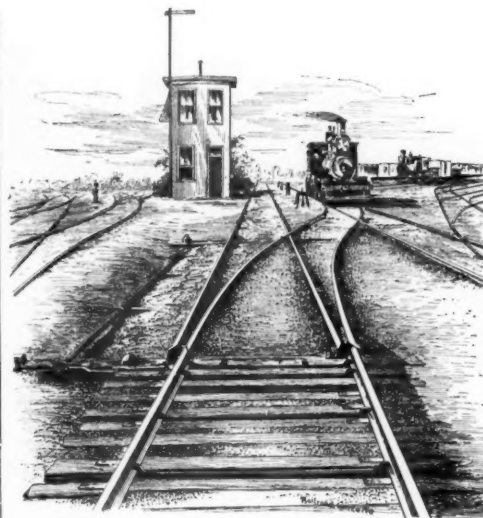


Fig. 4.

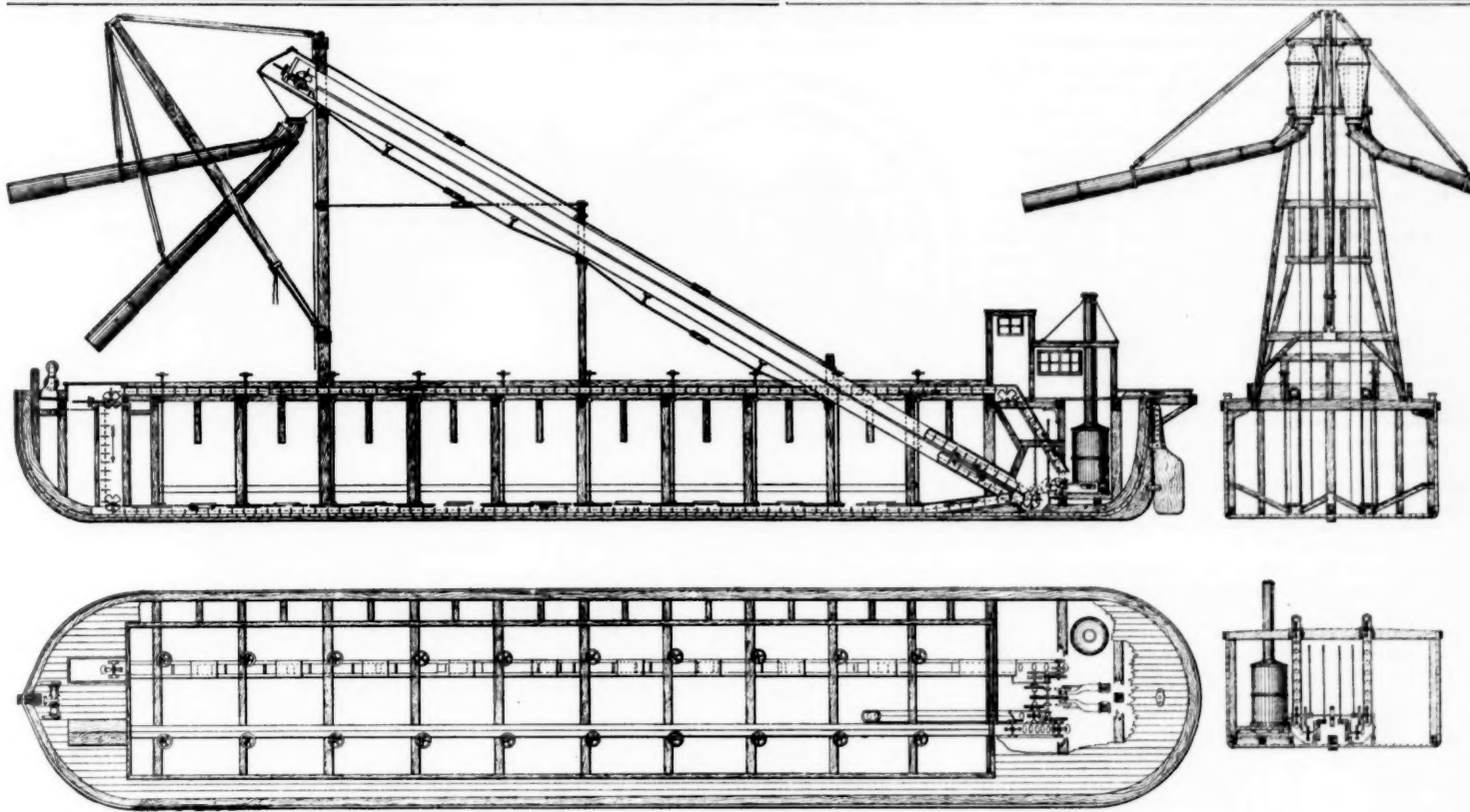
fast by either side or by the bow at the place where the coal is to be delivered, and need not be moved until the operation is finished. This will be an advantage at large coal receiving depots, as on a bulkhead of 200 ft. water front seven barges can be discharging at one time, or at the rate of 1,400 tons per hour. At the great coal station at Duluth 7,000 tons of coal are discharged in 24 hours with steam buckets, requiring 30 engines and 3,300 ft. of water front for the maximum operation.

This system may be used to coal vessels while under way, and is also well adapted to use in stormy weather, as the coal can be completely housed. The same apparatus is applicable to handling grain, salt, broken stone, etc.

The barges of the United States Transportation Co. have been employed by the Consumers' Coal Co., Messrs. Ward & Oliphant, Messrs. C. G. Barber & Co., and recently to load 2,000 tons of coal for the United States government for shipment to Samoa. The Mallory line of steamers have lately been coaled by this system, and plans are now under way to introduce a system of spouts on those vessels by which coal can be received from a floating elevator and deposited in the coal bunkers directly, doing away with the delay and annoyance of coal trimmers, wheelbarrows, etc., and with much of the wear and tear of the process of coaling.

Test of Marine Engines at Sea.

The Institution of Mechanical Engineers (England) has recently appointed a Research Committee to obtain details of the performance of marine and stationary engines, locomotives, etc. The first report of this committee relates to trials of the engines and boilers of the steamer "Meteor," belonging to the London and Edinburgh Shipping Co. This is the only account which has been published of the performance of modern marine engines, with full measurements of coal and water consumption, power, etc.; and the essential features of the report are herewith presented, condensed from *The Engineer*.



COAL HANDLING BARGE OF THE UNITED STATES TRANSPORTATION CO.

The "Meteor" is 261 ft. between perpendiculars, 32.1 ft. beam, with a moulded depth of 19.3 ft. On the occasion of the trial, the mean draft was 15 ft. 1½ in., and the displacement 2,090 tons. The engines are of the triple expansion type, built by Messrs. J. & G. Thomson, of Clydebank, Glasgow. Diameters of cylinders: High-pressure, 29½ in.; intermediate, 44 in.; low-pressure, 70 in. The cylinders are set fore and aft, with cranks spaced at equal distances apart, and are jacketed on the sides but not on the heads. The stroke of the engines, 47.94 in.; the diameters of the piston rods are each 7 in.; tail-rod of high pressure cylinder, 4.45 in., and of the other cylinders, 4.37 in. each. Live steam is admitted to each jacket, and the jackets driven into pockets fitted with glass gauges. The cylinder clearances are: High pressure, 12.4 per cent. of piston displacement; intermediate, 9.3, and low pressure, 8.02. Piston-valves are used, one for the high pressure cylinder and two for each of the other cylinders. During the trial the link of the high pressure cylinder was adjusted for a nominal cut-off of 26 in., and the other links were set at full stroke. There is a surface condenser with 3,200 sq. ft. of condensing-surface. The air-pump is worked by a beam connected to the main engines, and these are wide-pendent engines for the circulating and feed-pumps. The propeller has four blades, 14 ft. 10 in. in diameter, with a mean pitch of 23 ft. The actual area of the blades is 78 sq. ft., and the projected area, 57.6. During the trial, the propeller engines and the feed pump were supplied with steam generated in the main boilers, and the other auxiliary engines were supplied by the donkey-boiler; but the exhaust from the engines used to drive the circulating pump and dynamo was taken into the condenser and measured. The measurement of condensed steam was effected by discharging the water from the hot-well alternately into two tanks, from which the feed-pump drew its supply. The feed-water was heated by live steam before its admission into the boiler.

There are two double-ended boilers, each containing 6 furnaces. The boilers are of steel, with Fox's corrugated flues; diameter of shell, 13 ft. 6 in., length, 16 ft.; external diameter of tubes, 2½ in., length, 6 ft. 4½ in. The grate-surface

is 208 sq. ft., tube-surface, 5,760, total heating surface, 6,648; ratio of grate-surface to tube-surface, 27.2; of grate-surface to total heating surface, 32. The grate-bars are in two lengths, 25 bars in width, air-spaces between bars about ½ in. wide. There is one chimney for the two boilers, with a double shell; internal diameter, 7 ft. 3 in.; external, 8 ft. 3½ in.; height above grate, 61 ft. Scotch coal from the Shawfield pit, in the Weibaw district, was used in the furnaces, its price at Leith being \$1.88 per ton, and its analysis by weight was as follows:

Carbon, 70.31 per cent.; hydrogen, 4.88; water, 10.68; ash, 3.46; nitrogen, sulphur and oxygen, 10.67. The coal was weighed in the bunkers before being put upon the fire-room floor in heaps of about 800 lbs. each; no more coal being delivered before this was fired. Samples of the products of combustion were collected, but unfortunately all of them were spoiled except one, which was supposed to represent average conditions. The temperature of the furnace gases was measured with a mercury thermometer having the space above the mercury filled with compressed nitrogen, so that the thermometer was capable of indicating temperatures above the boiling point of mercury. The boilers were operated with natural draft, equivalent to about ½ in. of water.

The trial was made on a voyage from Leith to London, commencing June 24, 1888, continuing 17 hours 6 minutes for the engines and 17 hours 19 minutes for the boilers. The fires were not cleaned until the conclusion of the trial. The distance run was 257 nautical miles, at an average speed of 14.6 knots per hour.

The following figures show the consumption of water and coal, with other particulars:

	Total	Per hour.
Feed water, lbs.	512,150	29,860
Coal, lbs.	68,693	4,005
Ash and clinker, lbs.	4,477	.....
Rate of combustion, lbs. per sq. ft. of grate surface.	6.51	.....
Evaporation per sq. ft. of heating surface, lbs.	0.602	.....

Average temperatures: feed water, 163.1 deg. Fahr., varying from 160 to 170 deg.; of escaping gases, 791 deg. Rev-

olutions of engines: total, 73,650; average per minute, 71.78, varying from 72.4 to 70.9 during different half hours. Pressures: barometer, 30.34 in.; boiler, 145.2 lbs. per square inch above the atmosphere. Average indicated horse power, 1,994, varying from 2,286, with 72.1 revolutions a minute and 147 lbs. boiler pressure, to 1,890, with 70.9 revolutions and 140 lbs. pressure. The distribution of the pressure and power was as follows:

	High pressure. Top. Bot.	Inter- mediate. Top. Bot.	Low pressure. Top. Bot.
Mean effective pressure, lbs. per sq. in.	60.6 56.82	20.47 18.54	12.22 12.55
Indicated horse-power	662	507	825
Initial pressure, lbs. per sq. in. above atmosphere	134.4	36.5	6.2
Pressure in jackets, lbs. per sq. in. above atmosphere	131	77.5	56.8
Steam accounted for by indicator diagrams, percentage of total feed	77.1	80.2	75.3

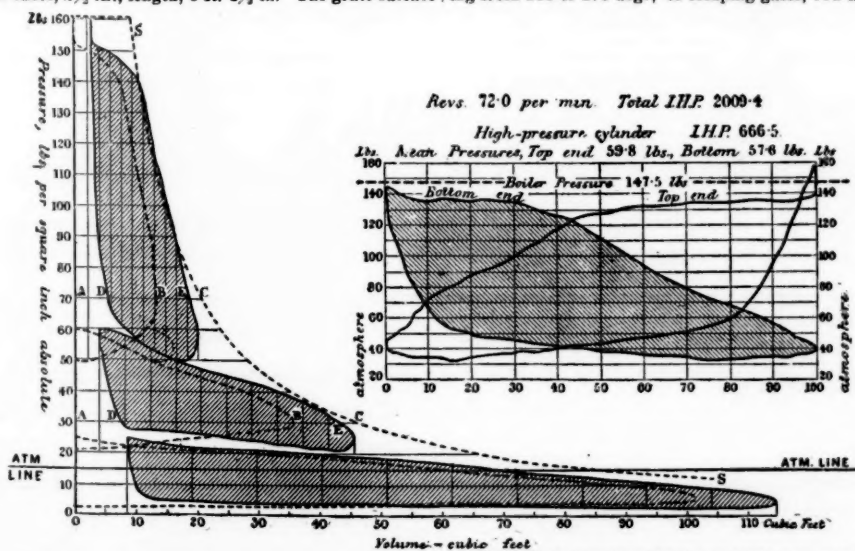
It was not found convenient to measure the steam supplied to the jackets. The vacuum in the condenser was 12.17 lbs. per sq. in., absolute; and in the low-pressure cylinder, 11.6 lbs.

The evaporation from the temperature of the fuel was 7.46 lbs. per pound of coal, and 8.21 lbs. from and at 212 deg., being about 62 per cent. of the total calorific value of the fuel. The analysis of the sample of furnace gases, assumed to represent the average, gave by volume: Carbonic acid, 12.5 per cent.; carbonic oxide, 0.8; oxygen, 5.4; nitro-81.2; corresponding to an air supply of about 22 lbs. per pound of coal.

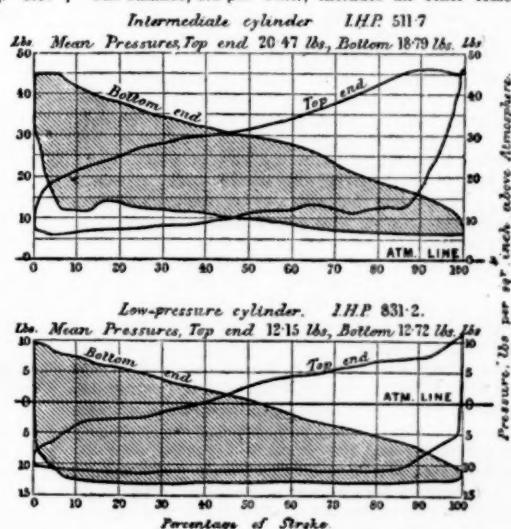
The heat accounted for in the fuel is as follows:

	Per cent.
In generating steam	62
In furnace gases	21.9
In carbonic oxide	3.6
In moisture in coal	1.2
In clinkers	3.0
	91.7

The balance, 8.3 per cent., includes all other losses, the



DIAGRAMS FROM TESTS OF THE S.S. "METEOR."



principal of which is radiation. The consumption of steam hourly per indicated horse-power was 14.98 lbs., and of coal 2.01 lbs. The boiler transmitted 5,244 thermal units per hour for each square foot of heating surface, and the engine expended 427 thermal units for each indicated horse-power per minute.

In calculating the efficiency of the plant, it is assumed that the limits of temperature between which the engine was operated were from 363 deg. Fah. to 120 deg. On this supposition the actual efficiency was 54.6 per cent. of the efficiency of a perfect heat engine operated between the same limits; and the efficiency of the whole plant, engines and boiler, or the ratio of the heat converted into work, to the total heat of combustion of the fuel, was 10 per cent.

The weight of the engines and boiler, with water in the boilers and spare gear, is 390.5 tons. The figures illustrate average diagrams, corresponding to the mean indicated horse-power. In the figure on the left, the diagrams in full lines have been drawn to a common scale of pressures and volumes, the clearance of each cylinder being set off to the left of the corresponding diagram. *SS* is the saturation curve, and the dotted outlines show the diagrams set back, so as to show the actual volumes of steam in the cylinder at any working pressure.

The boilers of the "Meteor" are adapted for forced draft, on the closed fire-room system; and after the conclusion of the trial just described, the fires were forced, with the following results:

SUPPLEMENTARY TRIAL WITH FORCED DRAFTS.

SERIES.	Boiler pressure, lbs. per sq. in., above atmosphere.	Revolutions per minute.	Mean indicated pressure, lbs. per sq. in.			Indicated horse-power, per sq. in.			Total.
			High-pressure cylinder.	Intermediate cylinder.	Low-pressure cylinder.	High-pressure cylinder.	Intermediate cylinder.	Low-pressure cylinder.	
A.....	146	81.0	60.9	28.4	18.5	778	832	1,393	3,003
B.....	151	81.0	63.2	28.8	19.0	808	844	1,426	3,078
C.....	150	83.1	30.2	33.7	24.1	397	1013	1,863	3,273
D.....	145	78.7	64.1	25.5	16.7	796	727	1,222	2,745
E.....	136	81.0	32.9	33.0	21.8	415	957	1,617	2,989
F.....	130	80.0	31.2	32.9	21.6	394	952	1,608	2,954

In series C, E and F, live steam was admitted into the first receiver, an auxiliary starting-valve, $2\frac{1}{4}$ in. in diameter, being provided for this purpose, to be used when the boiler pressure is rising rapidly, so as to prevent any steam being blown off and wasted.

A set of diagrams were taken when the engine was backing, and are interesting as showing the different distribution when the sequence of the cranks is reversed. The boiler pressure was 147 lbs.; revolutions per minute, 76; vacuum, 27 in.; and the mean indicated pressures and power were as follows:

	Mean indicated pressure, lbs. per sq. in.	Indicated horse-power.
High-pressure cylinder.....	48.8	585
Intermediate ".....	31.5	867
Low-pressure ".....	17.1	1,298
Total indicated horse-power.....		2,690

The Jewett Metal Truck.

The truck which we show herewith is one which has had considerable trial on some of the New England railroads, particularly the Fitchburg. It is made of metal throughout, and either of the rigid or swing beam style. The one which is shown here is a swing-beam truck, which weighs about 4,530 lbs., for a 60,000-lb. car. The essential features of this truck are: (1) A transom and bolster, each made of a single plate of mild steel. (2) A carrying truss of BB iron in place of the ordinary inverted arch-bar. (3) The load is carried directly over the arch bar with a swing motion by means of a link. (4) Malleable iron is used for all castings. (5) A triangular malleable casting is introduced under each arch-bar to prevent sagging.

Fig. 1 shows a side elevation of the truck. 1 is the upper arch bar, $2\frac{1}{4} \times 1\frac{1}{4}$ in., 2 is the carrying truss of $1\frac{1}{2}$ round iron, taking the place of the inverted arch bar. It passes around the end of the arch bar, and is made with a single weld. The clip (3), made of malleable iron, relieves the journal box bolts of shearing strains. The load is suspended by a stirrup link (4) of $1\frac{1}{2}$ in. round iron, which passes over the rocking saddle (5), which in turn rests on a seat directly on the arch bar. It will be seen that the load is carried directly over the arch bar with a swing beam. The triangular malleable casting (6) is placed under the arch bar to prevent sagging.

Fig. 2 is a plan of the truck arranged for inside brakes. The tie (9) is used to hold the truck rigid where the transom is subjected to the pull of the brakes. Fig. 3 shows the stirrup link (4) and the saddle (5). These links have been tested to 300,000 lbs. to a truck. The breaking strength of the carrying trusses was found by tests at the Government arsenal to be 200,000 lbs. per truck. In this stirrup is a lower spring seat, 14 (fig. 1) on which the spring seat proper rests.

Fig. 4 shows the steel bolster, made of $\frac{3}{8}$ metal, for a 60,000-lb. car. The inverted plan shows the way in which the plate is turned under the bottom of the bolster, giving it the advantages of the tubular form. Malleable iron forms (10) are used to preserve the shape of the bolster. One of these bolsters tested at the Watertown arsenal endured a load of 120,000 lbs. at the centre. The deflection with a load of 90,000 lbs. was .145 in. It is claimed that the truck is ab-

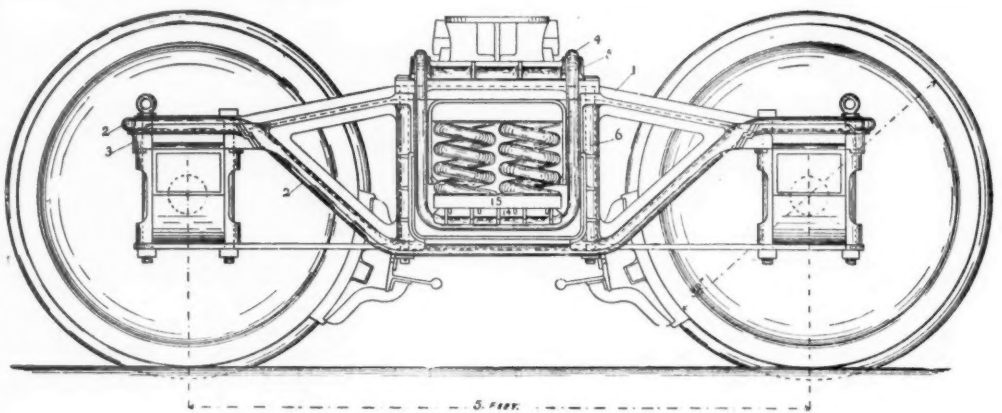


Fig. 1.

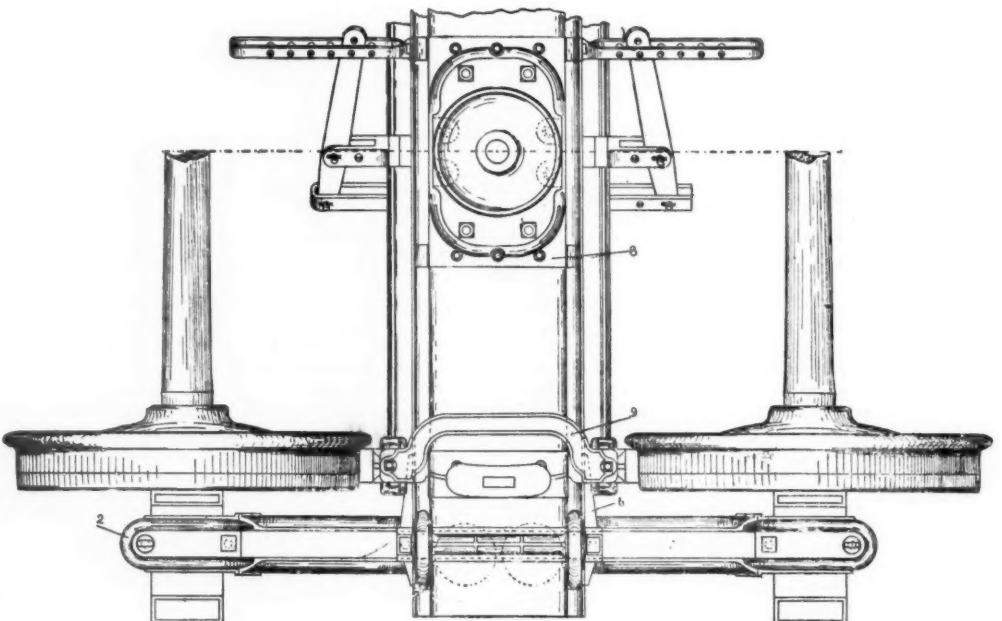


Fig. 2.

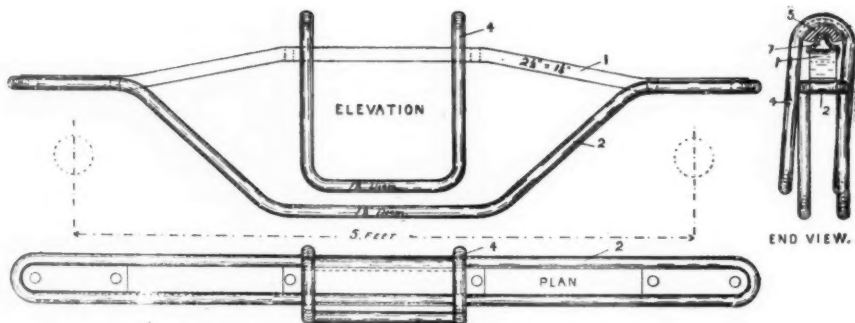


Fig. 3.

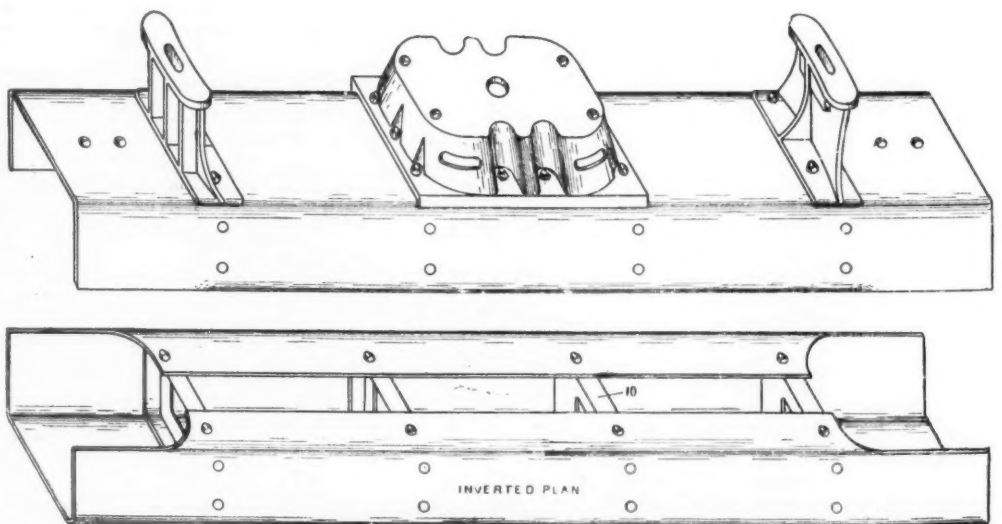


Fig. 4.

THE JEWETT METAL TRUCK.

Made by HARRISON LORING, CITY POINT WORKS, Boston, Mass.

solutely centre-bearing, the deflection of the bolster being in no case as much as the clearance of the curve plates.

In fig. 5 is shown the transom made of the same material as the bolster. It is stiffened by four internal frames, the end frames having bearings for brake hangers and wearing plates. It will be observed that the malleable casting 6 is riveted to the transom in such a way as to keep the truck square.

This truck has been in process of development over three years, and there are now more than a thousand of them in use on railroads in New England. It is stated that last winter a car carrying a heavy load of steel blooms was derailed by a broken axle, and while one arch bar was broken and the other completely doubled up, the bolster and transom of the Jewett truck were in a condition to be used again at once.

Moving Turn-tables by Compressed Air.

We show herewith a detail of a device patented by Mr. John D. Bowman, Assistant Mechanical Engineer of the Pennsylvania Railroad, for use in moving turn-tables at round-houses. It is operated by compressed air taken from a drum situated on the turn-table or from the main drum on the locomotive itself.

Fig. 1 shows the drum and the connection to the propelling mechanism. Fig. 2 shows the propelling device. Its operation is as follows: To the pipe *J* is connected either the hose on the back of the tender or that leading from a stationary air pump. Through this pipe *J* the drum *F* is charged. The pipe *G* conducts the compressed air from the drum to the valve *H*. When this valve is opened compressed air flows to the valves *R*¹ and *R*², which admit air to the driving mechanism *E* and *E*¹, as shown. Thus by operating the handles of the valves, the driving mechanism is operated.

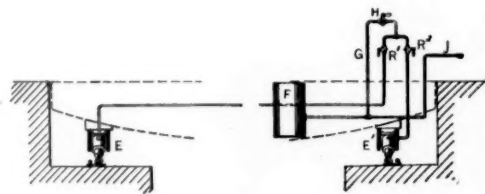


Fig. 1.

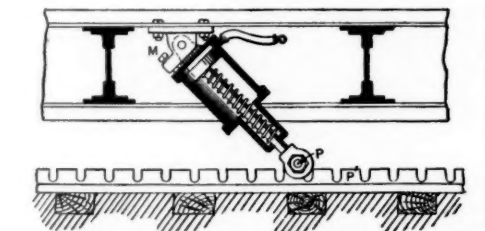


Fig. 2.

In fig. 2 is shown the driving mechanism in section. The air enters the cylinder through a flexible hose, drives the piston forward and causes the pin *P* to engage with the teeth in the rack *P*¹, which is continuous around the pit. As the table moves the pin drags along over the teeth in the rack, and is ready at any time for a succeeding stroke after the air has been discharged through the valves *R*¹ or *R*², on the turn-table, and the spring in the cylinder has driven the piston back to its initial position. The cylinder is hinged at one end, and can rotate freely about that point within the limits prescribed by the floor of the table and the set screw *M*. This set screw serves to control the length of stroke of the piston, and can be adjusted so as to move the table any desired amount with one movement of the valve handle. The driving cylinders are in duplicate and placed at opposite sides of the table, both pointing in the same direction. One cylinder actuates the table in one direction; the other cylinder moves it in the opposite direction.

THE SCRAP HEAP.

Notes.

City ticket offices in Buffalo will hereafter be closed on Sunday.

A tramp stealing a ride on a freight train of the Memphis & Charleston road, one night recently, was killed by some of the trainmen, who threw the body on the track, where it was run over by a train.

The Chicago, Burlington & Quincy is soon to begin running second-class sleeping cars between Chicago and Denver. The Rock Island already runs such cars between Chicago and Colorado points, we believe.

The agent and the operator of the Montana Central at Silver City, Mont., were killed by two robbers on the night of June 4. Both robbers were pursued by the sheriff and killed, they having refused to surrender.

A Chicago paper notes the fact that the Michigan Central officers recently indicted for violating the Inter-state Commerce law have been charged with 52 separate offenses, each of which makes the guilty party liable to a fine of \$5,000. The aggregate is thus \$260,000.

The Maine Central announces a through daily train between Bar Harbor and Chicago, to commence running June 30. It will travel via Portland, Fabyans, N. H., and the Boston & Lowell, Central Vermont, Rome, Watertown & Ogdensburg and Michigan Central. The time is about 63½ hours.

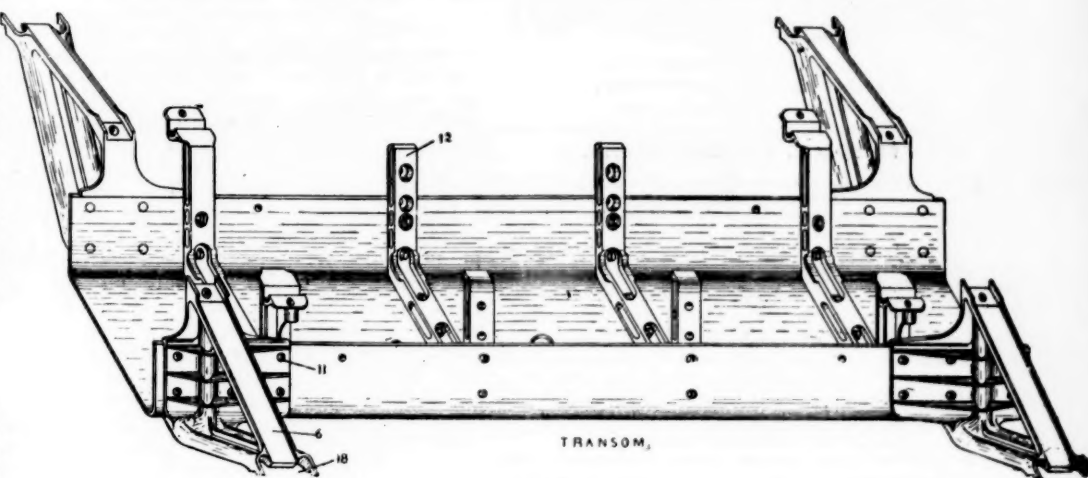


Fig. 5.

THE JEWETT METAL TRUCK.

Omaha Demurrage Bureau.

Mr. A. A. Jones, Demurrage Commissioner of the Omaha Bureau, which is the pioneer organization of its kind, contributes to the *Equipment Guide* an account of the working of his office, in which he says: For all the yards, which include Omaha, South Omaha, and Omaha Belt Railway, it requires four check clerks. The yards are divided into districts, each check clerk going over his respective district daily, starting in the morning at the same point and going over his route in the same order each day, so as to be at the different tracks about the same time daily. A complete check of all cars is taken, including loaded and empty. This requires about all the forenoon. In the afternoon he enters all cars into the record books. A regular ledger account is kept with every consignee on his route. After all cars have been entered into the records, a daily report is then made up and sent to the agent, showing all cars which have been detained over 48 hours, giving car number, initial, location, consignee, and amount due. The agent then makes an expense bill and collects, rendering a weekly report to this office, showing amount collected. A report is then made up in this office and sent to the superintendent, showing the amount collected and uncollected. The bureau is conducted on a very simple plan, and one that has proven very effective and inexpensive.

For 15 months, ending Dec. 31, 1888, the balance sheet of the office shows:

RECEIPTS.		EXPENSES.	
Collected by		Pay roll.	\$5,328
U. P. Ry. at Albright.	\$41	Rent, fuel, stationery,	
" " So. Omaha.	206	etc.	1,159
" " Omaha.	4,867	U. P. profits.	2,334
B. & M. " So. Omaha.	10	B. & M. profits.	1,953
" " Omaha.	5,683	Mo. P. profits.	696
Mo. P. " Omaha.	1,623		
	\$10,610		\$10,610

New Central Station, Salem, Mass.

The Salem Electric Light Co., finding its present station entirely inadequate to the needs of its business, is now erecting a new one designed by the Thomson-Houston Electric Co. The new station will be a model of its kind, and in its construction are combined many new features and improvements in central station work. The engine and dynamo house is two stories high, the electrical apparatus being on the upper floor. This building is built of brick throughout, and is 102 ft. long and 56 ft. wide. The boiler-house is 92 ft. long, 54 ft. wide, and 23 ft. high. The chimney is 130 ft. high, 6 ft. inside diameter and 13 ft. square at the base. The foundations are rubble stone placed on spruce piles, capped with concrete. The steam plant, which is compound condensing, consists of one 350 h. p. double tandem compound engine, made by McIntosh & Seymour, and one 150 h. p. high-pressure Fitchburg, now in use at the present station. The boilers were made by the Cunningham Iron Works, and are 3 in number, 6 ft. in diameter, 17 ft. long and 125 h. p. capacity each. There is one 1,200 h. p. surface condenser, a Knowles air and circulating pump and a feed-water heater situated in a smoke flue. The station is built to allow the addition of 1,000 h. p., and there is room for 9 additional boilers and another line of shafting. It has a capacity of 42 dynamos. At present there will be 14 in use, 11 arc and 2 alternating current machines, and one generator for railroad work. On the second floor are the store and testing rooms and superintendent's office.

United Order of Railway Employees.

Delegates from the Brotherhood of Railway Brakemen, the Switchmen's Mutual Aid Association and the Brotherhood of Locomotive Firemen, met in Chicago, last week, and agreed upon a constitution for the above-named organization, which the delegates say goes into immediate effect without further ratification. The governing body will be a Supreme Council, of which the following are the officers and members: President, F. P. Sargeant, Grand Master of the Locomotive Brotherhood of Firemen, Terre Haute, Ind.; Vice-President, Frank Sweeney, Grand Master Switchmen's Mutual Aid Association, Chicago; Secretary and Treasurer, Ed. F. O'Shea, Secretary and Treasurer of Brotherhood of Railway Brakemen, Galesburg. The six other members of the Council are S. E. Wilkenson, Peoria, and W. G. Edens, Bucyrus, O., for the brakemen; E. B. Debbis, Terre Haute, Ind., and J. J. Hannahan, Chicago, for the firemen; and G. W. Hall and W. E. Simms, Chicago, for the switchmen. The object of the consolidated association is not clearly explained. It is stated that the separate bodies still maintain their individuality, and that the officers of the new order retain their old places in the different associations.

A Heavy Car Load.

Pennsylvania railroad car 5,107 lately arrived in Denver from Trenton, N. J., laden with a coil of wire cable for the Denver City Cable Railway Co. The weight of the cable is 100,970 lbs.; it is a trifle over 7 miles in length, and is said to be the largest single wire cable ever shipped by the Roebeling works. The car on which the cable was shipped is constructed of steel, with 16 wheels, and weighs 54,400 lbs., the total weight of the car and its load being 155,370 lbs.

Train Accidents in Great Britain.

The Board of Trade report for the calendar year 1888 shows the following accidents on the roads of the United Kingdom.

Collisions, passenger.....	35
" passenger and freight.....	54
" freight.....	12
Derailments, passenger.....	53
" other.....	11
Miscellaneous, including 1 boiler explosion.....	21

In addition to these the report gives breakages of tires, axles, wheels (only two), rails, etc., which caused no train accident; but these figures cannot be intelligently summarized from the data given, as train mileage, number of cars in service and other facts are wanting.

The casualties were as follows:

	Killed.	Injured.
Passengers in train accidents.....	11	594
" other causes, including their own negligence.....	96	814
Employees—Train accidents.....	7	93
Other causes, etc.....	389	2,100
Other Persons—		
At highway crossings.....	53	24
Trespassers.....	239	114
Suicides.....	65	—
Miscellaneous.....	54	87
Total.....	905	3,826

Other casualties on the premises of the railroad companies bring the total up to 977 persons killed and 8,507 injured.

The statistics are not guaranteed by the Board of Trade. The small proportion of freight train accidents shown in the report indicates that the companies report only the more important cases. Some of the principal accidents are described more fully in another column.

Trans-Caspian Notes.

Mr. Charles Marvin writes to the *Alababad Morning Post* that the Russians are now running two stern wheel steamboats to Karki, the head of navigation on the Oxus, and that they are paying great attention to diverting the waters of that river eastward, so that it is hoped with the fuller utilization of the Murghab and Tejend it will be possible to establish a band of cultivated country the whole distance from the Oxus to the Caspian. Repair shops have been opened at Kizil Arvat. Three times as much Bokharan cotton is waiting shipment at Azoun Ada as last spring, and five new steamers are being put on to meet the increased traffic. A congress to discuss the development of the cotton industry met at Askabad in April, at which place the Russians are erecting a cathedral and have laid out 300 acres for the cultivation of tobacco.

A Russian colony has been started at Karki, and General Annenkoff is strongly in favor of planting several thousand Russian families on the Murghab. As showing the thorough pacification of the country, Mr. Marvin says: "Trade between Askabad and Meshed is rapidly on the increase, and caravans can pass between the two places without the slightest fear of thieves."

The Brotherhood of Locomotive Engineers.

A Chicago paper printed last week a brief article claiming to show that P. M. Arthur, Chief of the Brotherhood of Locomotive Engineers, was unpopular among the members of that organization; that he was engaged in an electioneering tour among the various lodges; and that in a meeting at Chicago he was sharply questioned on his attitude in the matter of strikes. His answer, as reported, was, that under no circumstances would he ever sanction another strike; that the inexorable laws of supply and demand would render any attempt in that line a certain failure. Mr. Arthur was subsequently interviewed by the *Cleveland Plaindealer*, and states that he has been misrepresented. He makes little explanation of the true state of affairs, except to say that he is not a "candidate" for re-election, never having solicited any favors from the Brotherhood. They must elect him voluntarily if at all. The meeting at which he is reported to have been questioned was held May 23, and Mr. Arthur hints that the story has been cooked up since then.

Alabama Railroad Valuation.

The Alabama State Board of Assessors has completed its valuation of the roads of the state, and reports a total of \$40,163,776, an increase over last year of \$4,855,919. This valuation only includes roadway and rolling stock, all other property, real and personal, being assessed in the counties by the local assessors.

Kansas Railroad Valuation.

The Kansas Board of Railroad Assessors has just completed its assessment of the railroads of the state and reports the following figures: Total miles main track in the state, 8,706.17; total value of main track in the state, \$43,165,654; total miles of side track, —; total value of side track, \$2,247,456; assessed value of buildings, \$1,917,093; total value of rolling stock, \$8,894,971; total value of tools, material, money and credits \$765,387; total value of telegraph lines, \$497,566; total assessed value of all property, \$58,448,128.



Published Every Friday,
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

Among the topics to be considered at the Master Mechanics' Convention are the purification of feed-water, the thickness of tires, the proportions and details of boilers, such as exhaust pipes and nozzles, bearings, boiler covering, brakes, proportions of grates and flues, and water space around fire-box. Several of the committees have issued circulars of inquiry, treating the topics in considerable detail, and from the answers already received it is anticipated that much valuable information will be obtained. If this is carefully digested and tabulated it will prove very useful. Every one who has attended conventions of this kind understands that the preliminary work of the committee is for scientific purposes the most important. It will hardly be denied by an experienced designer that for each type of locomotive in use there are certain proportions and details which should be standard, and the best means of establishing proper standards is that taken by the various committees. Many of the matters on which information is desired can only be determined by trial, and it is hoped that the members of the Association who have made experiments have communicated the results freely. The topical discussions in certain recent conventions have been both interesting and useful. With a carefully prepared list of questions and an efficient presiding officer who has the faculty of bringing bashful and reticent members to their feet, this feature of a convention may be made more generally interesting than the more formal programme. The two horrible train accidents in Canada this year (St. George, Feb. 27, and Hamilton, April 28), resulted from causes that should vitally interest Master Mechanics. The former was from a broken tire, about which no definite information has been published. The discussions, therefore, need have no lack of a practical side.

The Chicago, Milwaukee & St. Paul has arranged to conform to the ruling of the Executive Board of the Inter-state Commerce Railway Association, and will turn over to its competitors all live stock traffic from Missouri River points except two train loads per week. This settles for the time being one element of contention. Whether the quarrel about lumber will settle itself remains to be seen. The Alton, as everybody expected, has refused to maintain the old rates; but it hints at the possibility of a compromise. Whether the live stock award settles matters or not, it brings the question of pooling squarely before the public. Freight has been diverted from the St. Paul road by an arbitrator's award, simply because that road had in the time immediately past been carrying an unusual proportion of live stock. The Inter-state Commerce law says that "it shall be unlawful for any common carrier, subject to the provisions of this act, to enter into any contract, agreement or combination with any other common carrier or carriers for the pooling of freights of different and competing railroads." It is of the utmost importance to know whether the diversion of freight under an arbitrator's award necessarily comes within the term pooling or not. If it does not, we are better off than we thought

we were. If it does, it is well to know it. Nothing but harm could come from a postponement of the issue.

The possibility of a war on Transcontinental business is coming sufficiently near to make people ask what will be the effect of the short haul clause under such circumstances. If the Commissioners hold to their original principle, as enunciated in the Louisville & Nashville decision, the short haul clause will have no effect whatever. This view of the matter is confirmed by recent dispatches from Washington which are supposed to reflect the opinion of the Commission, if not actually inspired by it. The decision with regard to Missouri River rates, which has been quoted to prove the contrary view, dealt with business on which the Canadian Pacific was allowed no differential. It was, therefore, presumed to have retired from the competition, and the rate was treated as having been fixed by the independent action of the American roads themselves. This was not necessarily true, for one railroad might be compelled to use a low rate to prevent possible competition, as well as to meet such as actually existed. It might be, in other words, that the Canadian Pacific did not compete at all when the rate was low, but would have done so to a disastrous extent if it had been made a trifle higher. Still the assumption underlying the decision was that such rates were not actually controlled by Canadian competition; and even if that assumption was partly wrong in point of fact, it must be accepted as marking the intent of the Commission itself. In through shipments of wool and many other staples whose rates are now under discussion, the case is different. The competition of the Canadian Pacific is not merely a fact, but an acknowledged fact. The existence of differentials proves that this is so; and the gain in Canadian Pacific business may readily constitute a ground for showing that the present conditions of competition are unequal and onerous. If the Southern Pacific or any other railroad should see fit to lower its through rates to the level of those charged by the Canadian Pacific without corresponding reduction in local rates, it would be very difficult for the government to deny its right to do so. The Louisville & Nashville opinion implies the existence of such a right; and however much the Commission may have exerted itself to make the observance of the long and short haul principle as general as possible, we cannot believe that it would refuse to admit an exception in this case. This is one reason why we have thought that the benefits to the Canadian Pacific accruing from the Inter-state Commerce law have been overestimated. The operation of the act has doubtless hampered the American roads to some extent, and produced a corresponding gain to their Canadian rivals. But the exaggerated statements of such loss on the one hand and gain on the other, prove too much. If half the things were true which are charged in this connection, the transcontinental roads would have openly cut loose from the short-haul principle; and the country would have justified them in so doing.

A terrible collision resulting in the death of 72 passengers is reported in the cable despatches from Ireland as we go to press. A train of 15 carriages on the Great Northern of Ireland on Wednesday morning loaded with several hundred Methodist Sunday School excursionists from Armagh became stalled on a grade and had to be cut in two. While the engine was gone with the front portion, the rear portion, which had been "blocked with stones," escaped control and ran back four miles at high speed into the head of the following passenger train, with frightful results. This is exactly the kind of collision that American conductors and brakemen compel us to record every month or two, as happening to freight trains, but negligence of this kind with passenger trains is most painful and deplorable. While with the very poorest braking power there should be no excuse for experienced trainmen who allow a standing train to escape from them, it is probably true that the antiquated system, which still permits long passenger trains to be run with very inadequate brake power, must bear the heaviest moral responsibility in this case. Even the disastrous freight collisions of this kind which we have here are generally not chargeable to poor brakes, but to the foolishness of men who will go to sleep in the caboose. With a loaded passenger train, men who will go to sleep and those who are content to run 80, or even 50 per cent, of the vehicles without any brake power whatever, would be regarded as about equally culpable. But the exact facts about the weight of this train, the number of brakemen and the brake apparatus available are not yet reported, so we must suspend judgment.

Automatic Couplers and Continuous Brakes.

We present herewith some statistics of vertical plane couplers and of freight train brakes which will serve to give a good general idea of the progress that has thus far been made in the use of these important appliances. Most of the figures given have been furnished by officers of the roads, though as a few have failed to answer our inquiries and other reasons have rendered it impossible to get exact figures in every case, the totals probably fall somewhat short of the actual facts and are to be taken only as giving a general indication. For this they are clear and amply sufficient.

List showing number of freight cars in use equipped with couplers of the Master Car-Builders' (vertical plane) type and of freight cars equipped with the Westinghouse Automatic Air Brake.

	Vertical plane couplers.	West. automatic brake.
Allegheny Valley.....	200	.....
Atchafalaya, Topeka & Santa Fe and controlled roads.....	3,000	19,524
Atlantic Coast Line.....	500	50
Atlantic & Pacific.....	.....	50
Baltimore & Ohio.....	320	100
Chesapeake & Ohio.....	100	300
Chicago & Alton.....	.....	150
Chicago, Mil. & St. P.....	.....	270
Chicago & Northwestern.....	.....	.....
Chicago, Burl. & Quincy and controlled roads.....	302	2,270
Chicago, R. I. & P.....	1,500	1,000
Cleve., Col., Cin. & Ind.....	1,500	251
Colorado Midland.....	.....	747
Denver & Rio Grande.....	.....	1,130
Denver, Texas & Fort Worth.....	.....	232
Duluth & Iron Range.....	.....	1,122
Fitchburg.....	.....	576
Grand Rapids & Ind.....	87	.....
Intercolonial.....	.....	240
Kan. City, Wy. & N. W.....	.....	384
Lake Shore & Mich. So.....	500	51
Mich. Central.....	75	300
Milwaukee, La. S. & W.....	.....	350
Mobile & Ohio.....	.....	150
New York Cent. & H. R.....	8,000	2,783
New York, Chi. & St. L.....	150	60
New York, Lake Erie & W.....	2,783	1,314
New York & New England.....	60	68
New York, N. H. & Hartford.....	.....	5,183
Northern Pacific.....	.....	150
Old Colony.....	.....	600
Oregon, R. & N. Co.....	.....	.....
Pennsylvania and controlled lines east of Pittsburgh.....	3,240	2,878
Penn. lines west of Pittsburgh.....	2,900	2,386
Philadelphia & Reading.....	.....	100
Pittsburgh & Western.....	.....	89
Railroad & Gaston.....	50	.....
Rich. & Danville.....	1,068	1,068
Seaboard & Roanoke.....	80	50
Seattle, L. S. & E.....	.....	91
St. Paul, M. & Manitoba.....	.....	550
Southern Pacific.....	.....	16,243
Spokane Falls & Northern.....	.....	75
Toledo, Peoria & W.....	.....	56
Union Pacific.....	.....	15,433
Wabash.....	60	100
Western N. Y. & Pa.....	2,000	400
West Shore.....	213	23
Merchants' Dispatch.....	.....	300
Private owners' cars.....	.....	5,100
Total number of cars with M. C. B. couplers.....	29,288	.....
Total number of cars with air brakes.....	.....	81,705

The patent facts observable from the information gathered are that the introduction of air brakes had several years the start of the couplers, as indeed was familiar knowledge to all acquainted with the practice of the roads west of the Missouri River; and that the large roads are not just now building many new cars. The Chicago, Rock Island & Pacific; Duluth & Iron Range; New York, Chicago & St. Louis; Old Colony; Richmond & Danville, and Western New York & Pennsylvania intend to put air brakes on all new cars, but this has little meaning until they give some large orders for building. The most progressive roads are decidedly in favor of adopting automatic brakes and vertical plane couplers at the same time, but they are well satisfied to use the brake with the link and pin coupler if they cannot get both improvements. The extended experience of the Trans-Missouri roads of course proves the feasibility of this with moderate trains. The order to trainmen to put air brake cars in the front of the train and to avail themselves of them is very general; one road makes the limit two cars; whenever there are three or more the brake is to be used.

The fact that the roads in the West which have long used the air-brake have kept their cars pretty closely on their own lines, naturally led to some fear that fitting the brake to cars used freely in interchange would result in considerable trouble and vexation, because of the injuries and neglect that the apparatus would suffer at the hands of careless borrowers; but the tone of the communications received shows this fear to be almost entirely groundless. All but two or three hundred of the cars shown in the list are lent to foreign roads in the usual manner without restrictions, and the testimony is almost universal that no unusual trouble has been experienced. The same may be said of the cars with automatic couplers. The very few who complain of trouble in making repairs or getting them made are officers of roads which seem to have taken no interest in the improvements. Owners say that borrowing roads return cars in good condition.

The number of private owners' cars equipped with

air brakes is a not inconsiderable item. Of the 5,189 included in the list 2,500 belong to two stock car companies. The New York Central and the Bee Line have applied the brake more largely to stock cars than to any other class. The former road puts vertical plane couplers in both ends of all cars which come to the shop for one new draw-bar. A number of roads report that all cars overhauled have their draft rigging fitted for the reception of M. C. B. couplers; this is an admirable preparatory work, which, if universally done, would materially mitigate the evils of the transition period.

The geographical distribution of the progress thus far shown is very easy to remember. Seventy-two per cent. of the air brakes are on the large systems west of the Missouri, which began a number of years ago. Aside from these, the Pennsylvania, Erie, Burlington and Rock Island cover about all that cannot be called experimental. The Duluth & Iron Range takes decided ground, and the Richmond and Danville has begun with over 1,800 cars. Fifty-seven per cent. of the couplers are on the Vanderbilt and Pennsylvania systems and the Atchison, Rock Island and Erie have over half of the remainder. It is to be expected that a season of general and active building must be waited for before a lively movement in couplers will be manifest, for the new roads are likely to be less forcibly impressed with the necessity for reform than are the experienced officers of the older and larger lines.

The American Society of Civil Engineers on Rail Sections.

Papers and discussions of unusual interest are promised for the Convention of the American Society of Civil Engineers next week. The final report of the committee on the relation of wheels and rails will, we suppose, be made, and so far as we can learn now will be essentially what was foreshadowed in the preliminary report which was made last year, viz., that the upper corner of the head should be of considerably smaller radius than the wheel fillet, and that the sides of the rail head should be vertical. There are suggestions also that a crown radius of 12 in. will be recommended. This, however, is but conjecture. The tendency toward these characteristics has evidently progressed fast in the last two years, if we may judge from the recent rail sections which have been shown in these columns. If, as we surmise, there is now found in the answers to the committee's circulars a great majority in favor of the small corner radius and straight sides, it will but confirm what we said in March a year ago in answer to a correspondent who assumed that the tendency was exactly the other way. If, by chance, it should happen that we have misinterpreted the signs of the times, and that the majority is still on the other side, we should be surprised, but not convinced.

Excellent examples of the application of what seems likely to be the prevailing theories of design of rail sections for the next decade were shown in the eight sections by Mr. Robert W. Hunt, published in the *Railroad Gazette* last week. Those were eight sections of rails, from 60 to 90 lbs. per yard, all designed with broad heads, 12 in. crown radius, $\frac{1}{4}$ in. upper corner radius and straight sides. One aim in the design of those sections was to give a stiff rail, and at the same time to avoid excessive concentration of metal in the head. The sections are tall, therefore, with comparatively heavy webs and flanges. The average distribution of metal in the eight sections is given below, compared with some other standard sections:

	Percentage in—		
	Head.	Web.	Flange.
Hunt.....	41.25	21.21	37.54
Mich. Central, 89-lb.....	42.36	20.91	36.72
N. Y. C. & H. R., 89-lb.....	41	19	37
Pennsylvania, 85-lb.....	47	17	36
Reading, 90-lb.....	49	19	32

It will be seen that Captain Hunt's sections correspond very closely in distribution of metal, as they do in other particulars, with the Michigan Central standard, while they depart widely from the proportions of the Pennsylvania 85-lb. section, which is a good example of average recent design, although unusually heavy. The Pennsylvania 85-lb. rail is 5 in. high, while that of Captain Hunt is 5 $\frac{1}{2}$ in. and his 90-lb. rail is 5 $\frac{1}{2}$ in. high.

The considerations which have led to the thin and broad head have been much discussed the last year, and our readers are familiar with them. The importance of making the rail with a lighter head as stiff as, or even stiffer than, the old section is probably being more generally recognized than it has been here, tofore. It is seen that in track not heavily ballasted it is particularly necessary to have a rail that will not bend under the increasing weight of

traffic. We expect, therefore, to see the heavy sections of the next few years made high and comparatively slender, with thin heads. It is interesting to see the same ideas as to width of head and height of rail growing in Germany, where American practice in all technical matters pertaining to railroads is very closely watched.

One of the difficulties in rail design is that it takes so long to find out one's errors. When a wrong idea gets into a section it takes several years to get it out, because, as a rule, the fault can only be proved by actual trial in the track. For a long time after roads of heavy traffic began to pretty generally increase the weight of their rails, the added metal went to make the head higher, and it is only recently that many of them have become convinced of the radical error of that practice. Even yet it is by no means universally recognized. If, therefore, the ideas that are now coming into vogue are wrong, the sooner they are found out the better. The American Society's committee has doubtless gathered evidence enough from actual experience to settle some of the questions about the form of rail head. It is doubtful if the committee can add much more than speculation, of greater or less value, to the question of crown radius, and the height of rail and distribution of metal do not come directly within the scope of the inquiry.

The Railroads of the World.

We publish elsewhere the more important parts of an article on this subject in the current number of the *Archiv für Eisenbahnwesen*. These figures have special interest from the unusually rapid railroad development of recent years, and particularly of the year 1887. Nearly one-third of the world's railroad mileage has been built since 1880, about one-fifteenth part of it in the year 1887 alone. Of course the new countries have a proportionately larger share of development. If we confine our attention to the four years from 1884 to 1887 (not the five years from 1883 to 1887, as stated by the *Archiv*), we find that the increase in Europe has been only 13 $\frac{1}{2}$ per cent., while in other continents it has varied from 29 to 48 per cent. Of countries with any considerable mileage the development has been most rapid in the Argentine Republic, with 84 per cent. increase in four years. Next come Brazil, Australia, British America, British India and Mexico. The United States is passing from the ranks of new countries to those of old ones, and its railroad increase during the period in question, though enormous in aggregate amount, was in ratio only a trifle above the average for the world as a whole. Of the more important European countries, Italy shows the greatest ratio of increase, being scarcely behind the United States in this respect. It is followed by Austria, France, Russia, Germany and England, in the order named. The increase railroads in England now amounts to little over one per cent. annually.

Belgium enjoys the largest railroad mileage in proportion to its area, having fully 25 miles of railroad to every 100 square miles. Some parts of Germany, such as Saxony, show a ratio scarcely less than this; but Germany as a whole has only 12 miles of railroad to every 100 square miles of territory, while Great Britain has 16 miles and Holland 13. Switzerland has not quite 12 miles to 100 miles of area, and France only a little over 10 miles. Of course, thinly settled countries cannot make a good showing in this respect as compared with densely populated states; yet the United States has 4 $\frac{1}{2}$ miles of railroad for every 100 square miles of territory, which is a better average than that of Europe as a whole.

If we compare mileage with population the results are reversed. Here we find the highest ratio in Australia, with an average of 27 miles of railroad to every 10,000 inhabitants. In British America the ratio is almost the same. In the United States it is computed at 25 $\frac{1}{2}$ miles of railroad to 10,000 inhabitants. In the Argentine Republic the ratio is fully half that in the United States. In no part of Europe is it much over one-third, and in Europe as a whole only about one-seventh, or less than 4 miles for every 10,000 inhabitants. Of the more thickly settled European countries Switzerland has, on the whole, the best ratio, with 6 miles for every 10,000 of population. France has about 5 $\frac{1}{2}$ miles, Great Britain, Germany and Belgium each a little over 5 miles.

The figures of capital are on the whole a trifle less than those which are given in most computations, but they seem about as trustworthy as such figures can be made. The average of capital per mile of railroad in the world shows a tendency to diminish which is not at all surprising when we consider how much of the older mileage was in the thickly-settled districts, where the cost was necessarily higher. Apart from this difference, however, there is a tendency in many states to

pursue a somewhat more conservative policy in capital account than has hitherto been the case. The capitalization per mile of English railroads remains, and it is likely to remain, more than 50 per cent higher than that of any other country. It is now about \$204,000 per mile. France and Belgium come next, while Germany and Austria are much lower. The figures are given in detail elsewhere. Among countries outside of Europe the most expensive system is that of British India, which is estimated at \$67,000 a mile. The most expensive of the Australian railroad systems have a little higher average cost than those of the United States, but for Australian and New Zealand railroads as a whole the general average is considerably lower. These figures of capital are especially interesting because they are given with more care and completeness than has hitherto been the case. We trust that the editors of the *Archiv* will be able in subsequent years to give us some general statistics of equipment and operation as well as of capital.

Ambiguity in Train Orders.

A Southern dispatcher sends us the following inquiry:

What share of responsibility for a collision occurring under the following circumstances should be put upon a train dispatcher?

The stations are located thus:

D	C	X	B	A
West				East

Work train engine is working as an extra between B and D. Engine 18 is to run from A to D, and receives the following order, which is also sent to engine 1 at C.

"Engine 18 will run extra from A to D. Work train Engine 1 will protect itself against extra 18 after 3:30 p. m. west of B." This is made complete at 2:53 p. m. Extra 1 left A at 2:55. Immediately after receiving the above order, the conductor of engine 1 asks to have his limits extended to A, and the dispatcher sends him at C the following: "Engine 1 will run extra from B to A, but will not pass B until extra 18 west arrives there," making it complete at 2:55 p. m. Engine 1, ignoring his order to protect himself, treats the latter order as a meet order, and runs into engine 18 at X at 3:50 p. m. There seems to be no question that the conductor and engineer of Engine 1 were guilty of gross carelessness or ignorance, but they claim that the order not to pass B until Engine 18 arrived misled them; that they thought it was intended as an order to run to B to meet Engine 18. Is it reasonable to expect a dispatcher to foresee such a blunder? If it is, what should he have done to guard against it?

There are two ways of looking at this case, as indeed at so many train accidents, and the superintendent doubtless felt obliged to punish both sides. It is true that the first order, requiring Engine 1 to protect itself west of B, was neither superseded, annulled nor executed, and therefore the conductor and engineer of that train were violating Rule 523 when they acted contrary to its provisions. But according to the practical way in which experienced managers look at these matters and the theory on which rules and forms are constructed and men are engaged, engineers and conductors, either because they are burdened with numerous cares, or else have not been fully trained for their positions, are prone to make mistakes in executing orders, and should therefore never be compelled to do any reasoning or comparing of which they can possibly be relieved. We can neither acquit nor condemn this particular dispatcher, because we do not know how young and inexperienced he is, how badly overworked he may be, whether he was appointed without proper training, who was responsible for his appointment, and so forth; but a general principle which is widely recognized, and a correct one, is that the dispatcher should foresee all blunders that can possibly be foreseen and take energetic measures to obviate them.

The second order covered movements between B and A; but the use of the word "pass" opened a loophole for a conductor, more or less thoughtless, to get an impression that it had some force west of B. If the language had been "but will not leave B until," etc., it would have been more exact. Still better would have been the phrase "keeping clear of extra 18." We cannot see that there would have been any great objection if the dispatcher had sent a message to the conductor and engineer of No. 1 reminding them that the previous order was still in force, though that is not a very good practice to encourage. But probably the best method would have been to annul the first order and issue a new one covering 1's trip from C to A. It is generally easier for the dispatcher to give additional orders than to revise and condense, making two or more into one; but, on the other hand, a multiplicity of orders is sure to increase the cares and perplexities of the conductor and engineer; and, as we said before, the rational method is for the dispatcher, who is supposed

to be so situated as to take a calm and comprehensive view, to take as much of the responsibility upon himself and put as little upon the trainmen as he possibly can.

Rule 523 might be improved. When the average trainman, whose literary-analytical powers are not likely to overflow with erudition, gets to ruminating on fine points, he will invent all sorts of hypotheses as to the exact intent of a sentence. Some of these will be suggested by a comparison of the following with Rule 523, as printed in the standard code:

Orders once in effect continue so until fulfilled, or until the dispatcher supersedes them or annuls them. Orders held by or issued for a regular train which has lost its rights, as provided by Rule 107, become of no effect as soon as the 12 hours expire, and conductors and engineers of other trains will govern themselves accordingly.

English Train Accidents.

Of the circumstances connected with the train accidents, of which accounts, condensed from the British Board of Trade reports, are printed in another column of this paper, the most common characteristics are the low speed of the trains and the comparatively slight personal injuries sustained. Of the 22 accidents embraced in this list and that printed May 24, not over three or four happened to trains running at good speed, and of the people hurt, though the number according to the reports was large, but few suffered any very serious injury. But it is not to be concluded from this that the English inspectors have to go begging for jobs. An American board of inspectors, if charged with the oversight of the 150,000 miles of road in this country, could keep itself pretty well occupied if it were to investigate only those startling accidents in which engines crash together and stand each other up endwise or cars are tumbled down 25 ft. embankments; but it does not follow that these are the only cases, or the only important ones, needing investigation. A slight collision on the New York Elevated or on the New York division of the Pennsylvania may be of more consequence to the public than a very bad one on a small road which is almost certain by the law of chances not to kill a passenger in the next 100 years. The English roads, with their dense traffic, which, large in the beginning, has grown constantly for half a century, and has compelled a parallel advance in safety appliances, must guard against the smallest dangers. And there are enough American roads with dense traffic to render a study of the same dangers profitable here. Of the 10,570 millions of passenger miles reported in the last Poor's Manual, 4,542 millions (43 per cent.) are credited to the New England and Middle states, though the mileage of road in those states is only about 18 per cent. of the total. Over 50 per cent. of the passenger traffic of the country is doubtless done on 15, possibly 10 per cent. of the railroads.

The lessons from the collisions occasioned by the London fogs should be valuable to us. It is true that trains seldom encounter such incredibly dense fogs as the Englishmen tell of, but the principle is the same, and its application is but slightly, if at all, different. It appears from General Hutchinson's report on the Norwood Junction collision that a tower man needs to have two or three, or perhaps more, assistants whom he can send out to ascertain the exact whereabouts of switching engines and trains by feeling of them, as it were. While this can be necessary in very few places outside the neighborhood of London, it is important everywhere to see that signalmen never take it for granted that a train has passed a fouling point simply on the ground that it has had time and opportunity to do so. Fast passenger trains, fully protected by the block system when on the open road, must necessarily pass through many station yards where switching is done and where the only rational protection must depend upon the ability of the men in charge of movements to actually see the trains with which they are liable to conflict. Under the old methods a switch engine would be guided by watch and time-table in keeping clear of the main track. Under the block and interlocking system the responsibility is partly shifted to the signalman, but the necessity of a good view still remains. Without it the only alternative is to keep the main track clear until the passenger train reaches the end of the block in advance and is reported back. "Running under control," when one can see only two yards before him, is out of the question; it is standing still. Even with a view of, say, 300 ft., "under control" means very slow indeed.

At Loughborough the lack of an audible signal was emphasized. General Hutchinson alludes to the value of an automatic signal of this kind, but although numerous devices for the purpose have been invented it does not appear that any have been put in use in

the United Kingdom. The Palmer torpedo signal, used in connection with semaphores, has now given excellent satisfaction on the Manhattan (elevated) road in New York for over a year, 100 or more being in use; so that neither American nor English roads need lack for reliable testimony on the subject. The killing of a fog signalman on the London, Brighton & South Coast during the exceptional fog above alluded to was made the subject of an inquiry in Parliament, and the company found it expedient to defend itself at considerable length. Experience in America, as well as in England, teaches that men by no means ranked as heedless or thick-headed will often fail to take proper care of themselves when on and around a railroad track in dense fogs; there is therefore a humanitarian side to the question of automatic signals.

American readers will almost imagine themselves at home when they read of the brilliant section master on the Londonderry & Lough Swilly road, mentioned in one of the paragraphs. We are not sure, however, that he has not outdone any similar exploit this side the water. A section master whose time-piece is three miles away and devoid of any regulator would be hard to find even in the wilds of Tennessee or Arkansas.

The Conemaugh Dam.

The break in the South Fork dam on the Conemaugh, near Johnstown, Pa., was examined by Messrs. A. M. Wellington and F. P. Burt, of *Engineering News*, and Mr. H. W. Brinckerhoff, of the *Engineering and Building Record*, June 5 and 6, less than a week after the disaster. From their reports and the statements of Mr. P. F. Brendlinger, who witnessed in 1880 the manner in which a former breach in the dam was repaired, the causes of the breaking away of the dam on May 31 are plain.

The first dam built by the State of Pennsylvania, about 1842, appears to have been well designed, and, except possibly in one feature, well built. According to the statements of Messrs. Brinckerhoff and Wellington, who examined the embankment remaining after the flood, it was a compact homogeneous mass of clay and gravel, with a facing of rip-rap on the slope exposed to the water. This is the best kind of dam that can be built, where the material is of the proper character, and such appears to have been the case here. Leading through the dam, at the bottom of the valley, was an arched culvert of stone masonry with cast-iron pipes laid in the masonry at the upper end. This culvert was the possible exception to the excellence of the dam.

According to Mr. Brendlinger's statement, when there was about 30 ft. of water behind the dam in 1880, there were streams of water passing through the masonry and spouting out of the joints each side of the face wall of the culvert on the down stream side. At that time there was evidently some defect in the culvert masonry, but as the dam was then nearly 40 years old, and had been breached and neglected for at least 20 years, and still stood, and the water came out clear, it is pretty safe to say that the culvert masonry was well built at the outset. And here it is well to reiterate the statement of fact above made, that no composite dam of earth and masonry and rubble stone is as scientific, as safe, and as durable as a homogenous embankment of selected earth well spread in thin layers and thoroughly compacted, with the water face protected from wash, and the boring of amphibias, and with its top high enough above floods to prevent its being overflowed.

This old, well-built dam was abandoned, neglected and breached, leaving a gap some 200 ft. wide at top, and about 40 ft. deep. In 1880 this gap was filled up with a heterogeneous mass of earth and rock, excavated from the hill side at one end of the dam, and dumped in from carts, beginning at one end of the gap on top and carried forward by a high dump across the gap, the material taking its natural slope, and no attempt being made to compact it. The inner slope toward the lake appears to have been covered with a better selected material, probably the clayey gravel of the surface soil in the vicinity. There was mass enough to withstand the water pressure, and it was, doubtless, practically impervious to water. But it was not compacted, and in course of time it settled considerably in the middle. The wasteway, 65 ft. wide, cut in the rock at one end of the dam, was partially obstructed by a wire screen to retain the fish in the pond.

When, then, the extraordinary flood of May 31 came, the waste way being insufficient to carry it, the water rose over the middle portion of the crest of the dam, which had settled, washed off the superficial covering of earth and undermined the lower slope until the pressure was too great for the incoherent rock fill to

withstand, and the mass of the material put in in 1880 went out almost bodily.

This appears to be all there is to it. It was not a "visitation of Providence," nor an "inscrutable catastrophe." It was the inevitable result of the neglect of the precautions which any engineer of ordinary experience and judgment in hydraulic work would have insisted on in the reconstruction of the dam.

News from the flooded region of Pennsylvania is still rather brief, so far as railroad affairs are concerned. The Pennsylvania Railroad finished a temporary bridge across the Susquehanna at Montgomery, 20 miles southeast of Williamsport, on Saturday night at 6.30, the work having taken just about one week; but the route westward from there via Lock Haven and the Bald Eagle Valley road to Tyrone was still unavailable, and trains were run through to Pittsburgh by way of the Philadelphia & Erie, and the Allegheny Valley road via Renovo and Driftwood. The bridge by which trains enter Williamsport was not made passable for several days after the completion of the Montgomery bridge.

Superintendent Pitcairn, of the Pittsburgh Division of the Pennsylvania, has issued an official bulletin concerning the trains lost in the Conemaugh Valley. He says:

As near as can be learned 19 lives were lost. Two cars, a passenger coach and a baggage car, of the trains at Conemaugh were washed away. The baggage car was found near by, and one coach was carried down to the debris at the Johnstown bridge. Some hours after the flood struck the train three Pullman sleepers caught fire from a burning car of lime, and were destroyed.

Mr. Pitcairn gives a list of names of those passengers thought to have been lost. Some of the passengers heretofore mentioned as being dead have turned up alive in various parts of the country, and probably some of the names now given may be those of persons still alive but not yet located. The three trains were on the side-tracks at Conemaugh station. No. 12 (the mail train) consisted of one express car, one combination car and two passenger cars. The first section of No. 8 (the day express) was made up of one baggage car, four day coaches, one parlor car and one passenger coach; second section, two postal cars, one express car and three Pullman sleepers, in the order named. There had been rumors that the dam would break, but nothing definite was known, as the wire was down east of Conemaugh and no warning could be given when the dam did break. The first real warning came from a work train, which had been repairing east of Conemaugh. At about 3:50 p. m. when the work train engineer saw the water coming, he ran his train into Conemaugh, with his whistle wide open and the flood following right behind him. Everybody outside of the side-tracked trains shouted that the water was coming, and ran for high ground. It was raining at the time, and nearly all the passengers were inside the cars. Some got out and ran for the hills, while others remained in the cars.

The baggage car and second coach of the first section of the day express were carried off and the engine of that section was upset, but the other cars and the other trains were only slightly damaged. A car of lime was standing on the track adjoining the three sleeping cars, and the water touched the lime, setting fire to the car. The train hands worked at the fire until they thought they had it under control, but it broke out again about 4 A. M. Saturday, and the flames communicating to the sleepers, they were all three destroyed. The passengers, however, had all left the cars the evening before.

The task of the railroads in the Johnstown region was of considerable magnitude aside from the work of repairing the damaged road-bed. The Baltimore & Ohio's line reaching Johnstown from the southward was comparatively unharmed, and was overburdened with freight and passengers going to the relief of the sufferers. One hundred car-loads a day were hauled for a time, and the delivery of clothing and provisions had to be made from the freight car doors to the consumers. The Pennsylvania road was crowded with passengers from Pittsburgh. There was some complaint in the newspapers of harsh treatment of passengers, the trains stopping short of Johnstown, and not being provided with sufficient cars, but no definite evidence of mismanagement is given. On Monday of this week the work of clearing up the debris in the Conemaugh Valley, which had been carried on under the direction of an improvised committee, was assumed by the State of Pennsylvania, and Governor Beaver contracted with Ryan & McDonald of Waterloo, N. Y., to undertake the work. It will take several thousand men a month or two.

The Railroad Commissioners of Kansas, after hearing the remonstrances of the railroads, have reaffirmed their previous decision that freight rates between Wichita and places west of there, and all places on the eastward within a radius of 75 miles, may be reduced about 20 per cent. in order to enable manufacturers and wholesale dealers there to compete with those of Kansas City, Mo. The Commissioners say: "We cannot be blind to the fact that the manufacturing and commercial interests of Kansas City derive the principal benefit of this discrimination in freight rates. We have never been put in possession of any good reasons why the railroads built upon Kansas soil in part with the money of her people should be employed in such a manner as to repress development and enterprise within the state and determine the location of capital and business at a point immediately beyond her border. We are quite unable to imagine, and no one has revealed to us, a single reason founded in justice or good business policy, why Missourians living in Kansas City, competing for the trade of Kansas, with Kansans living in the interior of the state and pursuing the same line of business, should be given 20 per cent. the advantage over the Kansas man in transportation rates over Kansas railroads. The logic of our decision in this case is that the Kansas man is entitled to be placed in this respect upon a condition of fair equality with the Missourian." A

number of other cities and "trade centres" have already signified their intention of demanding the same favorable treatment accorded Wichita.

A Chicago dispatch states that the New York, Chicago & St. Louis one day last week accepted a train load of cattle for Boston in the American Live Stock Company's special stock cars in consequence of a threat from the shipper to have the road indicted under the Inter-state Commerce law, for discrimination, if the cars were refused. The agreement of most of the roads leading out of Chicago eastward to refuse private owners' cars seems to have had quite a marked effect in diverting traffic. A statement is published showing the number of car loads of stock forwarded over the principal roads for the month of May, with comparisons showing a large increase on the Grand Trunk, which did not join in the agreement. The figures are:

Roads.	May, 1888.	April, 1889.	May, 1889.
Chicago & Grand Trunk.....	1,633	76	70
Lake Shore & M. S.....	1,486	2,415	2,172
N. Y. C. & St. L.....	1,329	1,198	965
Pitts., Fort Wayne & C.....	936	1,039	562
Michigan Central.....	1,047	1,253	1,822
Chicago & Atlantic.....	1,611	1,721	608
Baltimore & Ohio.....	622	520	348

The notices issued by some of the roads at the time of the attempt to put a stop to the high mileage expenses and other disadvantages connected with the running of these cars, gave evidence of considerable carelessness, regarding the bearing of the legal questions involved, and the action of the Nickel Plate is doubtless the most sensible that could be taken. The change from stock-yard feeding to feeding on the cars seems likely to be increasingly regarded with favor, not only by promoters of certain cars, but by some railroads as well, and whatever legitimate objections there are to the new cars must therefore be met in a rational way on their merits.

Northwestern rates have been still further demoralized. At a meeting held last week with a view to patching up some sort of an agreement the Chicago, Burlington & Northern announced a further reduction, making its proportion on traffic between St. Paul and the seaboard 28 cents (first class) instead of 34 as announced a few days previously. The St. Paul & Duluth and the rail lines eastward from St. Paul via Sault Ste. Marie at once followed with further reductions, and the low rates are now in force by all lines. Chicago merchants at once complained of the discrimination against their city, and the Chicago, Burlington & Northern gave notice on Monday of this week that it would reduce the local rates between Chicago and St. Paul to a basis of 45 cents first class. Commissioner Iglehart, of the Chicago Board of Trade, said the merchants would not accept such a small measure of relief but would demand a reduction to 38 cents. Negotiations have been actively kept up and the lines through Chicago have tried to get the lines via the Sault (boats and railroads together) to say that they will accept 60 per cent. of the total traffic during the season of navigation; but there is no prospect of agreement in sight.

A Pittsburgh dispatch states that the very heavy falling off in traffic on the lines of the Pennsylvania system, resulting from the damage to the road by the Pennsylvania flood, has been followed by an order from the General Manager of the Pennsylvania Company making sharp reductions in expenses by curtailing work in shops and in various other directions. The newspapers have recently published reports from an unusual number of places to the effect that the superintendent of such and such a road has just made a tour of inspection and that in consequence sharp reductions in the number of employes and in the rate of pay will be at once instituted. It would appear that there is little difficulty in finding room for retrenchment on almost any road. One superintendent found himself enabled to double the work of certain station agents without crushing them to death, and is said to have discharged a number of telegraph operators without impairing the efficiency of the service. One report has it that a man had been drawing pay for several years for attending a railroad grade crossing which had been long since abolished.

Highway grade crossings, their dangers and the best way of removing them must by this time be well understood in Connecticut, if we may judge by the varied discussion on the subject in the legislature of that state. Bills have been passed, referred, amended, tabled and revived in all sorts of shapes. This week both houses have agreed upon a law providing that each road must change at least one crossing a year for every sixty miles of track [road]; but the railroad commissioners are to decide whether the road is financially able to do this. The commissioners also have power to close a crossing and substitute another. The expense of changes is placed upon the railroad where it petitions for a change. Where the town authorities are the petitioners and the highway existed before the road, one-quarter of the expense must be paid by the town authorities. Where the highway has been constructed since the railroad was built the commissioners may order the municipality to pay not to exceed one-half the cost.

A bill has been filed in the Circuit Court at Baltimore against the Baltimore & Ohio Relief Association by a former employe of the road. Misappropriation of the funds is charged, and the appointment of a receiver is asked for. The acting secretary of the relief association, who held control of the property when the charter expired on March 31 last, deeded it all to a certain "Real Estate & Improvement Company." The plaintiff claims that he was discharged from the employ of the road because he would not become a member of the asso-

ciation. This action, like that which resulted in the surrender of the charter of the association, seems to have been instigated by the labor organizations, and the motives of the chief movers do not clearly appear. It is to be hoped that if there is any real ground for grievance the court will have the facts brought clearly to light.

The legislature of Wisconsin has lately passed a law allowing railroad trains to pass draw bridges and grade crossings of other roads without stopping, provided that properly interlocked signals are in use. The terms of the law seem to indicate that the railroad commissioners can approve any "works, fixtures or appliances" which they believe will render it safe to pass without stopping. The same state has also established a law requiring railroad companies to clear their right of way of brush and trees for twenty rods on each side of highway crossings, except where the adjoining land is heavily timbered; in that case the road need take no action until the land is cleared. The owners of adjoining lands must also take measures to prevent the obstruction of the view of trains from the highway.

The roadmaster, whose communication on accidents appeared in a recent issue, called attention to the queer superstition that accidents "go in groups of three." It is not long ago that a general manager of wide and long experience, and of very high professional reputation, expressed to us his belief in this law. It is apparently held by a good many men. In matters of faith argument is useless, but we would suggest that limits of time and space be applied to this particular article of faith. For instance, must the three accidents follow one another within a week or within three months? Must they occur on one division, or within so many miles of each other? Are the limits wider where traffic is lighter? By formulating the belief in definite shape it could be tested by cold facts.

NEW PUBLICATIONS.

A Dictionary of Explosives. By Major J. P. Cundill, Royal Artillery. Published by the Royal Engineers' Institute, Chatham, and sold by Hamilton Adams & Co., London.

This work is based on a course of lectures delivered at the School of Military Engineering, Chatham. They are published in book form, with interleaves, so that notes on other new explosives which are constantly being brought out can be added.

The explosives treated of are divided into eight classes, as follows:

- I. Gunpowder, ordinarily so called.
- II. Nitrate mixtures other than gunpowder.
- III. Chlorate mixtures.
- IV. Nitro-compounds containing nitro-glycerine. This includes the great dynamite class.
- V. Nitro-compounds not containing nitro-glycerine, e. g., gun cotton.
- VI. Explosives in which picric acid or a picrate is a main constituent, picric acid itself being a nitro compound, and the separation being made as a matter of convenience.
- VII. Explosives of the Sprengel type, in which the principle is the admixture, just before use, of an oxidizing with a combustible agent, the constituents being non-explosive.
- VIII. Miscellaneous explosives.

No attempt is made to enumerate all explosive mixtures, such as coal gas and air, but as a rule only explosives as defined below in the English act of 1875 are treated of, viz.:

"The term 'explosive' in this Act—

(1) Means gunpowder, nitro-glycerine, dynamite, gun-cotton, blasting powders, fulminate of mercury and other metals, colored fires and every other substance, whether similar to those above mentioned or not, used or manufactured with a view to produce a practical effect by explosion, or a pyrotechnic effect, and

(2) Includes fog-signals, fire-works, fuses, rockets, percussion caps, detonators, cartridges, ammunition of all descriptions, and every adaptation or preparation of an explosive as above defined."

Some 460 different titles appear in the index.

The introduction treats briefly, in seven pages, of high and low explosives, with some theoretical and practical considerations, applying to explosives in general, and the author adds a few words of caution in his conclusion that may well be reproduced, as many persons using explosives are liable to forget some of the conditions, and inexperienced persons should be conversant with all.

1. The function of an explosive is to explode. Remember this in dealing with it.
2. If an explosive is described as absolutely safe under all circumstances, do not treat it as some people treat a big dog, and try how much it will stand. Prefer to see the truth of such assertions tested by the manufacturer or his agent rather than by yourself.
3. There is no explosive within my knowledge in practical use which when exploded in a confined space does not give off noxious or deleterious gases.
4. Do not expect the same class of explosives to do every variety of work. Different classes have their different functions.
5. If using an explosive with which special instructions (e. g. as to thawing dynamite) are issued, it is wiser to read them before an accident happens than to have to refer to them after the accident to see if they are not, after all, issued for some good reason and meant to be studied.
6. Do not apply the sense of taste to explosives. In the case of some, such as nitro-glycerine and nitro-benzole compounds, the consequences may be unpleasant; unnecessary handling of the explosive should also be avoided.

The Dictionary will be continued in an extra supplement of the *Royal Engineers Journal*, printed on one side of the paper only, so that the notes can be pasted to the blank interleaves, which can also be written on with ink.

The present knowledge of explosives was noted at some

length in the *Railroad Gazette* of Feb. 15 last, in reviewing Mr. W. H. Deering's paper on that subject. While there is no difference of opinion apparent between the two authors, Major Cundill's work is the more full, particularly in Chap. IV.: Nitro-compounds Containing Nitro-glycerine. He says: "Nitro-glycerine explosives, unless carefully made from pure ingredients, are apt to decompose spontaneously. Any indication of acid fumes, or any tinge of green in them, should be followed by their prompt destruction, with suitable precautions."

Nitro-glycerine uncombined is now very seldom used, but as it is still employed, it may be worth while to say that unless all free acid is removed from nitro-glycerine it is liable to spontaneous decomposition and as Drinker suggests it is always safe to test it for acidity. A little caustic soda in solution stirred into the can will remove that acidity and arrest any further decomposition.

Die Anwendung und der Betrieb von Stellwerken zur Sicherung von Weichen und Signalen. By Bau- und Betriebs-Inspektor Kolbe. Ernst & Korn, Berlin.

This book treats of central switch and signal stations and the various interlocking and safety switch and signal systems. The materials for the work have been gathered from a large number of technical journals and other sources, and from a great store of observations made by the author in the line of his duties.

The book is divided into three parts. The first part treats of central stations and operating and locking mechanism, and examples are given of arrangements, from the simplest to the most complicated. The second part describes a great variety of ground connections. The third part and appendix deal principally with instructions in regard to the working of the apparatus and the relations of the personnel, regulations, etc.

The author has, however, refrained from naming the inventors or manufacturers of any of the apparatus described, to avoid any appearance of partiality and lest any expression of preference of one system over another, emanating from him in his official position, might be used as an indorsement of that particular system. Probably most readers would rather he had been a little less scrupulous.

Collected Papers of the Civil Engineers' Club of the University of Illinois, 1888-89.—This is the third issue of an annual publication by the Undergraduate Society of the Engineering Classes of the University of Illinois. The pamphlet contains articles on a considerable variety of subjects of engineering interest. There are articles on the Masonry Arch, by Professor Baker, and Track Problems, by Professor Talbot. Otherwise the contents of the pamphlet are entirely by undergraduates. Professor Baker's table is essentially that published in the *Railroad Gazette* a few weeks ago. That of Professor Talbot deals with problems in laying out turn-outs. The secretary of the club is C. L. Crabbs, Champaign, Ill.

The Official Railway List, 1889. The Railway Purchasing Agent Co., E. N. Lewis, Manager, The Rookery, Chicago, Ill.

The appearance of this well-known book of reference only needs mention. Pretty nearly everybody who has occasion to use such lists as it contains is familiar with it. We have no means of knowing whether the edition of 1889 is in any way improved over former editions, but whether it is or not, it is a very convenient and useful publication. We would suggest, however, that convenience in its use would be gained by a different typographical arrangement. Those who have used Poor's Directory of Railway Officials will see at once the comfort of the typographical arrangement there adopted, although in other respects the "Official List" is the more convenient.

Transactions of the American Institute of Electrical Engineers. Special Meeting, March 12.—This meeting was devoted to the reading of a paper by Prof. E. L. Nichols, of Cornell University, on the Efficiency of Methods of Artificial Illumination, and to a discussion by members of the society. The paper, which is a very elaborate one, together with the discussion, appear in this issue of the *Transactions*, which may be had of the Secretary, R. W. Pope, 5 Beekman street, New York. The price is 50 cents.

Transactions of the American Society of Civil Engineers, March, 1889.—This issue contains a paper by Mr. William Starling on the Improvement of the Mississippi River, and one by Mr. George H. Henshaw on the Improvement of Channels in Sedimentary Rivers, with discussions by Colonel Craighill. It also contains a note on a clamp for pulling sheet piling by Mr. Charles T. Emery.

TRADE CATALOGUES.

Some Special Machines of the Union Switch & Signal Co.—We have received a pamphlet illustrating and describing a horizontal lever interlocking machine, a double ground-lever switch stand and a few other special appliances made by the Union Switch & Signal Co. The horizontal lever machine is designed especially to meet the demand for a cheap device for interlocking and signaling grade crossing and junctions and similar places where few levers are required and economy is very important. The interlocking is of the Stevens type, with preliminary action, and a simple electric lock is provided when desired, so operated that the clearing of the signal for any route will lock the switches over which that signal gives the right of way until the train has passed. Each lever is capable of operating two switches or two signals. At a plain grade crossing, therefore, but six levers are necessary.

The double ground lever stand is intended for the protec-

tion of an outlying switch by a distant signal. A novelty shown in this circular is a scotch block to serve the purposes of a derailing switch and to be operated from a signal tower. Four plans of track arrangements for interlocking, with tables of train movements, are appended, which will be interesting and useful to those who have occasion to study the subject of interlocking.

The Thomson-Houston Electric Railway System.—This is a pamphlet issued by the Thomson-Houston Co. containing a description of the street railroad system of that company, considered under the heads of "the power station," "the line" and "the motors." It is illustrated by process cuts from photographs of various installations, with several diagrams of line, etc. The pamphlet contains considerable information which would be of interest to people who are considering this subject.

Exhaust Steam.—This is a little pamphlet issued by the Hussey Reheater Co., summing up some of the experience had with the application of its system to various buildings, and giving some discussion of the advantages of the system.

Train Accidents in England.

We give below condensed accounts of certain important train accidents reported to the British Board of Trade in the last quarter of 1888, and investigated by the inspectors of that body. A number of accidents from the same document were reported in the *Railroad Gazette* for May 24, p. 335.

At London Road Station, Manchester, Dec. 1, on the London & Northwestern, a crossing collision between a passenger train just leaving a station and another one coming in was caused by the carelessness of the engineer of the outgoing train, who disregarded a semaphore signal which was plainly to be seen in front of him. Both trains were moving slowly. The incoming train was fitted with the automatic vacuum brake, but the engine was running backward and the brake was not in use. Col. Rich "hoped that the road would see the desirability" of fitting all the tenders of engines likely to be run backward with brake couplings at both ends. The engineer at fault, having been discharged refused, to attend the Government inquiry. He claimed the signal was pulled down.

On the London & Southwestern and London, Brighton & South Coast Joint Railway, at Portsmouth Town, on Nov. 12, a passenger train being backed into a head-house station on a branch from the main line was turned on to the wrong track and collided with a switching engine. It was a dark, wet night, and the collision was caused by the mistake of a signalman, who threw a switch without taking proper precautions to see if the passenger train had passed it. The company is recommended to fit the switches with proper safety appliances. They are, properly, trailing points, but when trains back into the station they become facing-points, and this practice of backing in is a regular thing. The inspector says that backing loaded passenger trains should be avoided as much as possible. It is conducted at this place by means of hand signals only, the guard standing on the rear of the train and signaling to the engineer by means of a lamp or lantern held stationary in the hand and made to show white, green or red, as may be desired, by moveable glasses in its side.

On Dec. 31 there was in the vicinity of London one of the worst fogs, even for that locality so noted for fogs, which had occurred in several years. Its density is referred to by several of the witnesses who gave testimony concerning the accidents occurring at the time. One engineer could see hardly a yard. A brakeman said he could not see a lamp light more than two yards. A signalman in a tower was compelled to keep track of trains and engines moving around in the yard, within 40 or 50 ft. of him, wholly by ear.

Two different collisions of important passenger trains were reported as having occurred in this fog. The first was on the London, Brighton & South Coast, at Norwood Junction, at 7.40 p. m. A south-bound train had left the station, and was supposed by the signalman to have proceeded to the next station; but it had stopped at the advanced starting signal, and a switching engine which the signalman then allowed to cross the main track ran into the rear car, injuring 18 passengers. The collision was very slight, but the car was knocked off the track, nevertheless. General Hutchinson is disposed to be lenient with all the men responsible for this collision. The engineer of the passenger train stopped at the advanced starting signal because he was unable to see the blade. The signal is located just beyond an overhead bridge, and in ordinary weather can be clearly seen at a distance (above the bridge), but on approaching closer it is hidden for a short time. The inspector recommends that this signal be supplied with lower arms to be visible under the bridge. There is a regulation that advanced starting signals shall not be used to hold trains in time of fog, and there was a claim that the runner ought to have depended upon this and kept on his way, but the inspector does not blame him. He says, however, that instead of stopping under the bridge, he would have done better to ask the signalman as he passed the cabin. He blew the whistle when he stopped, but it appears that he did not sound it vigorously enough to warn anybody. The signalman is not blamed for allowing the switch engine to use the cross-over track, although it is subsequently recommended that no crossings be allowed to take place while trains are running between block telegraph stations. The engineer of the passenger train and the signalman had each been on the road twenty-three years. The former had been on duty about thirteen hours and was to stay two hours longer. This long day of work occurs only

once in three weeks, but it is made a point of censure against the company, notwithstanding. The engineer of the switcher had been on duty thirteen hours, his ordinary day's work for five days in the week. This is criticised also.

The other collision on that evening was at Loughborough Junction, on the London, Chatham & Dover, and was investigated by the same officer, General Hutchinson. At 6.57 p. m. a passenger train standing at the station was run into by another from the rear, injuring 51 passengers, of whom two-thirds were in the forward train and one-third in the other. It appears that the engineer and fireman of the colliding engine both failed to see the red lights at Loughborough distant and home signals as they passed them. They claim to have seen the signals showing green, but their evidence is doubted. The fog had cleared off about 5 p. m., and the fogmen were sent home. On its sudden reappearance they were again summoned, but had not reached their posts at the time of this collision. In consequence of the absence of fogmen and the density of the fog it is believed that the signals were not seen at all, and that the first knowledge the men on this engine had of a train ahead of them was when a ticket collector on the platform shouted to them. In both this and the last-mentioned accident, the speed was very low, probably 6 miles an hour, which is all that prevented very serious consequences. Two block sections, one of them a short one, are under the control of one signalman at this point. This is claimed to be made perfectly safe by the special interlocking, but General Hutchinson thinks that when a train is standing at the platform, especially in case of fog, the signalman should be prohibited from admitting a following train until he first sets a facing-point switch behind the standing train, which would throw the other one upon a side track. General Hutchinson continues: The incidence of sudden fogs again directs attention to the importance of establishing some trustworthy system of mechanical or electrical fog signaling, which would be at once available for a signalman's use before fog signalmen can reach their posts. Mr. Sykes, of the London, Chatham & Dover Railway, who is well known for his arrangements in connection with electrical railway signals, informs me that he is about to try a plan which he thinks will accomplish the object in view. I trust he will lose no time in doing this, and that his arrangement will prove to be satisfactory. It is highly probable that no collision would have occurred had the London, Chatham & Dover's train been fitted with an efficient continuous brake in the driver's hands, instead of its having only hand brakes on the engine and on two vehicles out of the ten composing the train, as even in a distance of 30 yards, considering the slow rate at which the train was traveling, it might with a continuous brake have been stopped, or nearly so. The progress of this company in supplying its passenger trains with efficient brakes is lamentably slow, and considering the very important character of the passenger traffic, it is difficult to understand the apparent supineness of the directors as regards this matter.

On the Londonderry & Lough Swilly road, near Fahan, Ireland, Sept. 17, a short passenger train was derailed and the engine tipped over at a point where a rail had been removed for repair. There was no flag out, but when the engineer got within 350 ft. he met a man running toward him holding up a shovel. This road had lately been altered from a 5 ft. 3 in. gauge to one of 3 ft., and had been inspected by the government officers in 1887. The rails and sleepers were then quite unsatisfactory, and the company had been slowly at work bringing the line up to the standard demanded by the government. It appears that the section master, who had been on the road 12 years and a boss 1 year, had no watch and no printed or written rules, though he had been verbally instructed to use a red flag when obstructing the track. In this case he judged the time by observing the departure of a steamer at Ruthmullar, about 3 miles away, on the opposite side of Lough Swilly. The division road-master had certain rules written in a book and had communicated them verbally to the section men. He said it was hard to secure men for section bosses who could read and write. General Hutchinson says this is the only road within his knowledge which has not a set of printed rules, and he trusts that no time will be lost in supplying so serious an omission. The company is also censured for moving so slowly in renewing its defective rails. This particular rail could have been run over at low speed until there should be a safe time for removing it. The make-up of the train was also bad, the brake-van being in the front part of the train instead of at the rear.

On the Manchester, Sheffield & Lincolnshire, at Grimsby Dock, Oct. 29, a passenger train ran into the rear of a freight train, derailing two passenger cars and wrecking two freight cars. The engine of the freight had run around its train and was preparing to push it into a side track. The signalman lowered his signal for the following passenger train to come on while the freight still obstructed the main track. The view, both for the signalman and the trainmen was obstructed by a train on the adjoining main track (the line being on a curve) and also by a building and other cars standing near by. But Major Marindin blames the signalman, for, in spite of the adverse circumstances, he should have been able to see that the line was not clear; or, at any rate, if he was doubtful about it, could have used his telephone to inquire of the next signalman. At the same time, his offense is mitigated by unsatisfactory rules and practice in the working of traffic, which the report specifies in a half-dozen particulars: 1. The line was not worked under the block system; if it had been the collision could not have occurred without a more serious blunder. No reason appears why this part of the line should be excepted from block working. 2. A high, narrow brick build-

ing, used as an inspector's office, is in the worst possible position as far as signaling requirements are concerned. 3. A certain distant signal is never lowered. According to the rule trains passing it should always be brought to a stand before passing the home signal; but this is not done. It is a positive source of danger to retain rules which are not expected to be acted up to. 4. Other general rules have been regularly disregarded on the plea that the traffic could not be carried on if they were strictly adhered to. 5. Passenger trains are habitually run with the tender in front. This is much to be deprecated. 6. A rule limiting the speed between Grimsby Dock and Grimsby to 10 miles an hour was violated, but as the time-table requires over 12 miles an hour the runner is not held responsible. Other trains are timed to run at 20 miles an hour. The pushing of trains into the dock tracks is alleged to be necessary, but Major Marindin deems it objectionable because every operation of the kind necessitates crossing the opposite main line, which would otherwise be unnecessary. Seventy-four per cent. of the passenger train was braked with the vacuum brake, but the evidence, if correct as to distance, shows that the brakes worked badly. The engineer and fireman are found to be on duty 15½ hours on each of two days in the week. They have considerable intervals in this time during which they are standing still, but the hours are declared excessive.

At Leeds, on the Midland Railway, Dec. 18, during a dense fog, when none of the signals could be seen above a few yards, a passenger train ran into the rear of a freight, wrecking three or four cars and derailing one car in the passenger train. The cause of the collision does not very clearly appear. The line was worked under the absolute block system, but it appears that the regular bell instruments were not used, a conversation between the signalmen on the telephone taking the place of it. The signalman claims that after the freight passed a certain signal he threw it up to danger; while the passenger engineer, coming on soon after, claims that it was pulled off. "If the driver was at fault the accident would probably have been averted if there had been fog signals, or some other audible signal, at the spot, while if the mistake was made by the signalman it was one which might have been prevented by the use of one of the inventions by which the starting signal at one cabin is electrically controlled from the cabin ahead." Fog signalmen were stationed at distant signals, but not at the home and starting signals. The company claimed that during a widely extended fog the number of men available was insufficient to supply all the signals, but Major Marindin recommends that steps be taken to provide more.

At Ryhope, on the Northeastern Railway, Nov. 12, a passenger train starting from the station had proceeded but a few yards when it was stopped by the application of the Westinghouse brake by the rear guard and was run into by a pushing engine which was following very closely, intending to couple on to the train. The pusher should have been attached before the train started. The guard on discovering the error applied his brake before signaling the pushing engine to stop. It was the guard's duty to see that the engine was coupled on, but he had habitually left this to be attended to by the station master; and the regular station master was away on this occasion. The reason the guard did not signal the engine to stop was that his hand lamp had blown out just after he gave him the starting signal. The engineer of the pusher is not much blamed, though he should have stopped when he found that the train was going off without his firemen having coupled on to it. The practice of attaching helping engines to the back instead of to the front of trains is characterized as objectionable, and the more so, now that automatic continuous brakes are in use.

Gen. Hutchinson reports on a boiler explosion which occurred near Shildon, on the Northeastern, July 17. The barrel of the boiler of engine 590, built in 1879, exploded while the train was running 20 miles an hour. The engine had made 220,000 miles. The engineer had been running 29 years, and had had charge of this engine 8½ years. The engine was running with steam slightly on and the injector off. The pressure gauge indicated 120 lbs. The safety valves had blown off the day before at 130 lbs. No leaks had been observed since the engine came out of the shops in April, 1887. The explosion apparently commenced at the fire-box end of the horizontal joint of the lower middle plate, signs of grooving appearing there. This very probably had not commenced when the boiler was inspected internally in January, 1885. The boiler was made with lap joints. Gen. Hutchinson is "glad to learn" that this road is making all new boilers with butt joints. This boiler had never been tested with hydraulic pressure since 1879. The inspector seems to think that the advantages of hydraulic pressure tests outweigh any possible risk attending their use, but he is cautious about making any recommendation. During the seven years ending in 1881 this road had nine boiler explosions, but the one forming the subject of this report is the only one that has taken place during the last seven years.

Major Marindin makes a report on the killing of two trackmen by being run over by a train in a dense fog near Syston, on the Midland, Oct. 24. The men belonged to a gravel train and had just gone to work in the morning on a four-track road. It was hardly daylight, and the headlight of an approaching train could only be seen for about 30 or 40 ft. There are rules forbidding ballast trains to work on the main line during fog, and laborers are ordered not to cross over to the other tracks on the approach of a train, but to move to one side clear of all tracks. The rules, however, appear directed especially to the safety of trains more than to the safety of men, the latter being left in charge of the foreman. The two men killed stepped out of the way of a train only to find themselves in the way of another. They were new men and had neither read the rules nor had them

read to them by the foreman. Two section foremen had not read the rules to their men for several years though a rule required that this be done with every new man. The division roadmaster, who lives near the scene of this accident, stated that he would not, even if he had known that the men were at work, have deemed it his duty to go or to send to them to stop, considering that the section master alone was responsible. Major Marindin thinks, however, that he should have held a higher ideal of the responsibility of his position than this. "If every railroad officer would make it his duty to do all in his power to insure the carrying out of the rules, and perhaps go out of his way to bring to notice breaches of them, even when no evil results follow, there would be a marked diminution in the number of accidents of all kinds."

TECHNICAL.

Locomotive Building.

The Boston, Revere Beach & Lynn road has just received from the Taunton Locomotive Manufacturing Co., two bogie engines. They are of the improved Fairlie type and were built largely from drawings furnished by the road.

The Lake Erie & Western has placed another order with the Brooks Locomotive Works for three heavy freight engines, being the third order given these works for locomotives this year.

The Nova Scotia Central road has received from the Rogers Locomotive Works the third of an order for four locomotives.

Car Notes.

The Northern Pacific is in the market for 1,000 box cars.

An order for 500 refrigerator cars will soon be placed by the Louisville & Nashville.

The New York, Ontario & Western is asking bids for 1,000 freight cars.

The following orders for cars were let last week:

To the United States Rolling Stock Co., 700 for the Georgia Pacific, 500 for the Alabama Midland and 500 for the San Antonio and Aransas Pass.

To the Pullman Palace Car Co., 400 for the Georgia Pacific.

To the Haskell & Barker Car Co., Michigan City, Ind., 300 for the Iowa Central.

To the Missouri Car and Foundry Co., St. Louis, 200 for the Wabash Western and 51 for the Kansas City, Wyandotte & Northwestern.

To the Peninsular Car Co., Detroit, Mich., 200 for the New York, Lake Erie & Western.

The Newburyport (Mass.) Car Co. has received an order for eight open cars, four iron and four wood, from Newport, R. I. The works are being run at full capacity. They have orders now for 10 cars for the Boston, Revere Beach & Lynn road.

Harrison & Co., of St. John, N. B., are building 75 platform cars for the Nova Scotia Central road.

The Northern Pacific has just put in service two new Pullman sleeping cars, each having two staterooms provided with separate toilet rooms. The main gentlemen's wash-room is partitioned off, instead of being a part of the principal passage way of the car. The cars are supplied with hose, which can be attached to the toilet room faucets in case of fire. Both the drinking water and the hot and cold water are under constant air pressure, so that a stream to extinguish an incipient fire is always available. The Northern Pacific exhibited in connection with these cars a new Colonist sleeping car, in which the partitions between the berths are made solid, instead of with wire screens, as in the case of most cars of this kind.

Bridge Notes.

Proposals are wanted until July 2 for the steel superstructure of the King street subway at Toronto by the Chairman of the Committee on Works.

The contract for constructing an iron bridge over the Oconee River, at Milledgeville, Ga., has been awarded to George H. Crafts, of Atlanta, at \$11,680.

The contract for building a bridge for the railroad over Smith River has been let to the San Francisco Bridge Co. The price is \$23,000. The bridge will be 730 ft. long, with five spans, two of which will be 220 ft. each in length, one of 96 ft., and two of 97 ft., exclusive of approaches.

The County Supervisors ask for proposals for the construction of bridges across Preston Gulch and Walker, Hunter and Mattole Creeks, Humboldt County, Cal.

The Puget Sound & Gray's Harbor road has let a contract to the San Francisco Bridge Co. for the bridging and trestle work along the line from Summit to Montesano, W. T., for \$50,000. The only important bridge to be built is a single span across the Satsop River, 220 ft. in length.

Manufacturing and Business.

The Thomson-Houston Electric Co. has recently closed the following contracts for electrical street car propulsion: Fulton County, Atlanta, Ga., 8 miles, 8 cars; Attleboro & Wrentham, Attleboro, Mass., 6 miles, 5 cars; Americus, Americus, Ga., 4 cars; Auburn, Auburn, N. Y., 3 cars. The Thomson-Houston Electric Co. has furnished equipment for about 50 roads.

The Building Department of the Shiffler Bridge Works, Pittsburgh, Pa., is building an iron casting house for the Paducah Iron Co. at Paducah, Ky.; an iron roof for the engine house of the Ashland Iron & Steel Co., Ashland, Wis.; also, two iron buildings at the Black Diamond Steel Works for Messrs. Park Brothers & Co.

The Etna Machine Co., of Warren, O., has received an order from the Youngstown Bridge Co., Youngstown, for an engine to drive the machinery in the bridge works now building at Hazelton.

The Morse Twist Drill & Machine Co., of New Bedford, Mass., held its annual meeting last week. The officers were re-elected, as follows: Directors, Frederick S. Allen, Nathan Chase, Thomas M. Stetson, Andrew G. Pierce, Gilbert Allen, Edward S. Taber; Treasurers, Edward S. Taber; Clerk, Gilbert Allen.

The Peckham Street Car Wheel & Axle Co. has located works at Kingston, N. Y., and is equipping its shop with tools adapted for the manufacture of motor wheels and axles. The company has received orders during the last month from Union Depot Railroad Co., St. Louis, Mo.; Newburyport (Mass.) Mfg. Co.; Daft Electric Light Co.; and the Bentley Knight Electric Co. Also from the following cities: Dayton, O.; Port Huron, Mich.; Albany, N. Y.; Brooklyn, N. Y.; Asheville, N. C., and Newport, Mass.

The Thomson Electric Welding Co., of Boston, Mass., has sent one of its machines for welding metals by electricity to the National Tube Works at McKeesport, Pa. This machine is to weld from 1-in. to 3-in. extra heavy pipe, within

two minutes, and it is claimed that the interior surface will be left perfectly smooth and as strong at the weld as at any other part of the pipe.

The Phoenix Iron Works, Cleveland, has been engaged since Jan. 1, on outfit of cranes and machinery for the Aniston (Ala.) Pipe Works. The order includes about 25 cranes, ranging in capacity from 5 to 30 tons each, and will aggregate near \$100,000. This, in addition to other orders, has necessitated double time. These works have lately shipped a 5-ton traveling crane to the Volk & Murdoch Iron Works, Charleston, S. C., and a 10-ton pivot crane to the American Bridge & Iron Co., Roanoke, Va.

A. K. Bowman reports among recent orders the following: Two large boilers for the Kansas City, Wyandotte & Northwestern; a complete machine shop outfit for the Steel Car Manufacturing Co., St. Joseph, Mo.; a 26 in. shaper to the Ottumwa (Ia.) Iron Works; a 26-in. shaper to Smith Feed Water Heater Co. (second order); a large drill press to the Keystone Iron Works, Kansas City; a 38 x 18 in. lathe to Central Iron Works, Kansas City; a 19-in. lathe and heavy Universal milling machine to the Curtis & Co. Manufacturing Co., St. Louis; a 21-in. Lodge & Davis lathe to J. W. Garrett; and a machine shop outfit, consisting of three lathes, planer, drill press, bolt cutter, blowers, forges, etc., to Carrollton, Mo.

Iron and Steel.

The Columbia Rolling Mill Co., of Jersey City, N. J., has bought a portion of its mill machinery, covering about 100 tons, to be delivered this week, and the balance, including boilers, engines, etc., will probably be in place July 15.

Work on the new rod mill of the New Castle Steel Co., at New Castle, Pa., is progressing rapidly, and it is expected to be ready for operation Sept. 1, next. The plant will have a capacity of about 150 tons of rods per day, 100 tons of which will be used by the New Castle Wire Nail Co., while the balance will be sold in the open market. Employment will be given to about 100 men.

Huston & Sons, of Cratsville, Pa., have contracted for the erection of another large steel mill south of the present works, to be completed Jan. 1, 1890. The mill will be built entirely of iron and be fitted up with the most improved labor-saving machinery. A large steam crane will be used for conveying the piles to and from the furnace.

After a successful run of nearly four years, No. 11 furnace of the Thomas Iron Co., at Saucon, Pa., was blown out last week for repairs.

The Marietta Foundry, Marietta, O., has been succeeded by the Marietta Casting Co., recently chartered. Additional buildings are being erected and equipped for the manufacture of castings and hollow ware. The foundry is in full operation on light and medium castings.

The assignees of the Reading Iron Co. on June 5 obtained an order of sale of all the real estate of the company, and it will be sold in Reading July 1. The 28 properties include two anthracite furnaces, tube works, rolling mill and nail factory, ice machine plant, water works, cooper and carpenter shops, Scott foundry, steam forge, sheet mill, Gibraltar iron works, Camden tool and tube works and lots in Philadelphia and in Alsace Township. There is a mortgage for \$600,000 on the property.

The Rail Market.

Steel Rails.—Sales in the East this week have amounted to a considerable total, though the lots were from 500 to 1,000 tons. Inquiries for 15,000 tons are in the market. An order for 27,000 tons, which may be made 37,000 tons, is understood to have been placed with a Western mill. Manufacturers have been asked to bid on Mexican and Canadian orders. An increased allotment of 200,000 tons has been granted some mills. Quotations in the East firm at \$27.50 at mill, and at Chicago, \$29@30 for small lots.

Old Rails.—In the East sales have been made at \$22 for old iron rails, and at Chicago small lots are quoted at \$19.75 @ \$20.

The Williams System of Car Heating.

The Williams Car Heating Co. has just been organized, with Mr. Hugh McMillan, of Detroit, President; Mr. R. G. Chase, Treasurer and General Manager; Mr. R. B. Owen, General Agent. The principal office is 71 Kilby street, Boston, Mass. This system has been made known and brought to its present condition of efficiency during the ownership of Mr. Chase. As is well known, it is a return system, and has been developed and applied by the Pennsylvania Railroad. The system as used on an experimental train on that road was illustrated and described in the *Railroad Gazette* of March 15 and 22, 1889. The return system is considered by many mechanical engineers and specialists who have given this matter the most careful study as the one which is most likely to be generally adopted eventually, and we suppose that it is settled that it will be the standard of the Pennsylvania.

Track Inspection on the Indianapolis, Decatur & Western.

Mr. Edwin A. Hill, of Cincinnati, speaking at the last annual meeting of the Illinois Society of Engineers and Surveyors, gave some interesting facts concerning the premium system for excellence in track work. On the road above mentioned the section foremen are the judges, each foreman marking on every section except his own. This plan, Mr. Hill thinks, is better than to appoint the judges from among the roadmasters and division superintendents. The annual inspection is made a powerful educator of the foremen and they are spurred to keen rivalry. The responsibility of judging each other's work makes them more critical of their own and develops them generally. They appropriate points from each other, and the system tends to unify their practice and eliminate bad methods. The annual report has, besides the tabular information usual in such cases, brief comments upon the work of the foremen, including praise where appropriate and gentle admonition where necessary. The recipients of premiums also receive an engrossed diploma, signed by the President, Superintendent and Roadmaster.

The subject as given out in the programme for the meeting was "The advantages and disadvantages" of the premium system, but there appears to have been no one who knew of any disadvantages worth mentioning.

A French Compound Wheelock Engine.

A French contemporary describes and publishes finely executed illustrative plates of a 400 H. P. compound Wheelock engine, built by the Société Anonyme des Constructions Mécaniques, at Anzin. The engine is noteworthy in several respects, and a few particulars relating to it may, therefore, not be without interest.

There are two horizontal cylinders 18½ and 34 in. in diameter, and coupled at 92 degrees. Each of these cylinders with its valve gearing is placed upon an independent foundation, while the fly-wheel from which power is taken is mounted between them on a common shaft. The engine thus resembles very closely an ordinary coupled two-cylinder engine. A reheater for the steam passing from the high-pressure to the low-pressure cylinder is also placed transversely between the two. Two jet condensers are also provided, the air-pumps for them being mounted tandem

fashion with the steam cylinders. These condensers in regular working of the engine receive all the steam from the low-pressure cylinder. The whole design is such that the engine may be worked either as a condensing or non-condensing engine, and either compound or single. The advantages of this are several in number and are readily apparent. The transmission of power is by ropes, and the fly-wheel accordingly is grooved to receive them, 13 ropes being provided for. The governor, of the fly-ball type, is mounted on the foundation of the high-pressure cylinder, and the valve-gearing for both cylinders is fitted on the inner sides of the foundations.

All the exterior working parts are thus arranged within a comparatively small space and readily watched by the attendant. The connecting pipes between the cylinders and condensers are arranged underneath the foundations.

The steam chests are underneath the cylinders and above special exhaust chambers for the steam after having performed its work in the cylinders. The latter are jacketed. In passing from the high pressure to the low pressure cylinder the steam, as already intimated, traverses a re-heater. The latter is of tubular pattern and is surrounded by a live steam jacket. Of the valves we need say nothing special as they are sufficiently well-known.

It may not be amiss to add here that a simple 100 horsepower Wheelock engine was at work last year at the Brussels exposition, where it was given an award of honor with a gold medal.

Photographing Compressed Air Jets.

According to the *Industrie Zeitung*, of Riga, Russia, Professors Salcher and Riegler recently conducted an interesting series of experiments with the view of photographing a rifle ball in its flight after having been fired. A careful study of the photograph obtained is said to show waves in the air similar to those produced in water by a rapidly moving vessel. Encouraged by the success of the trials, and recognizing the fact that in the use of compressed air there are many yet unknown phenomena, Prof. Salcher undertook to photograph jets of compressed air issuing from small orifices. The air used was at pressures of 13, 16 and 18 atmospheres, and the opening from which it escaped measured 0.2 in. in diameter. Details and results are not given, but, when published, will, no doubt, be of considerable scientific interest. In any event, photography of the invisible may be said to have been successfully accomplished. We may add here that the electric spark was used for the purpose of illumination in the course of the trials.

A New Lake Steamer.

The "Seneca," the third of the 2,500-ton steel four-masted steamships built for the Lehigh Valley Railroad, to be used in its lake service between Buffalo and Western lake ports, was launched June 8 at Cleveland. The "Cayuga," the second of the three new steamers, started on her maiden voyage last week. The first ship put into service was the "E. F. Wilbur."

The Hawkesbury Bridge.

A test of the Hawkesbury Bridge was made April 24, under the direction of Mr. Dean, Inspecting Engineer of the Public Works Department, representing the Engineer in Chief of Railways. Various other Colonial officers were present. Six freight engines of 65 tons each, 16 trucks loaded with steel rails, each truck weighing 32 tons, and 2 brake vans, each weighing 10 tons, were made up into two equal trains and run upon the bridge. After the load had stood on the bridge about a quarter of an hour it was found that the average deflection was 2½ in. Apparently different spans were tested successively in this way. It is stated that the average deflection of the various trials was 2½ in. Engines were afterwards run across the bridge at the rate of 35 miles an hour with a deflection of 4 in.

New Elevator for the New York Central.

The New York Central & Hudson River road has filed plans for a new grain elevator and grain storage building, to be located on the Hudson River, between piers 60 and 62, New York City, the site of the big fire which destroyed two of the company's elevators last spring. The new building will cost about \$350,000. It will have a frontage of 100 ft. and will extend back 355 ft. from the water. It will have a projecting elevator tower 150 ft. high. The new structure will have a brick wall to the height of the first story. From thence to the upper roof line it will be sheathed with fire clay tiling or terra cotta blocks. All the roofs will be flat and the doors and windows will be coated with iron.

Electric Lights in the Grand Central Depot.

The New York Central has made a contract with the Edison Co. for putting an electric light plant into the Grand Central Station, New York City. It will require 1,400 incandescent lights to supply all the offices, passenger rooms, and the big train shed. No electric lights will be placed in the yards, as it is desired not to interfere with the signal lights, but the two-mile tunnel is to be strung with incandescent lights, hung on a level with the car windows and lighting up the tracks.

Grade Limits on Inclined Rack and Cable Railroads.

Mr. H. W. Hall, writing from Riel, Switzerland, has contributed to the *Schweizerische Bauzeitung* a timely article in which he discusses at some length the question of safety on inclined rack and cable railroads, with reference to the increasing gradients which have been proposed and, in part, adopted. We cannot, in the limited space at our command, follow him through his mathematical demonstrations, in which he attempts in a comparatively rough way to approximately determine, for a given set of conditions, the permissible angle of inclination for such roads, and would refer those of our readers sufficiently interested to the issue of May 4, 1889, of that journal for the details. Mr. Hall himself acknowledges that in working out the problem there are a number of data difficult, if not impossible, to obtain, and that he has attempted its solution merely on the basis of assumptions which may not be borne out by facts. Whatever the value of his deductions may be, however, in a practical sense, there can be no question that he has agitated a subject which deserves grave attention. Altogether too much reliance is at present placed upon brake power in the operation of these roads and upon the security of the gears and racks to prevent most serious accidents. As a matter of fact the racks are generally made as light as it is at all thought to be consistent with the supposed degree of safety, low cost of construction being evidently an item to which greater importance is attached. With cable roads the degree of inclination is perhaps of even greater weight in considering safety, and, as Mr. Hall properly observes, should the cables give way in some lines now in operation it would not be surprising to find that the limit of gradient had been reached where, however well applied, the brakes might be of no avail. The result in such a case can readily be imagined. The subject of safety clutches generally inoperative, and useless when most wanted, is also mentioned, and may well be looked into. Admitting the difficulty of fixing a grade limit within the danger line, measures should at least be taken to insure a liberal factor of safety.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Augusta & Savannah, \$3.50 per share.
Central of Georgia, \$4 per share, payable June 29.
Chicago & Northwestern,—1½ per cent. on preferred stock and 3 per cent. on common stock, payable June 27.
Chicago, St. Paul, Minneapolis & Omaha, 2 per cent. on preferred stock, payable July 20.
Cincinnati, Indianapolis, St. Louis & Chicago, quarterly, 1½ per cent., payable July 1.
Cleveland, Columbus, Cincinnati & Indianapolis, 1¼ per cent., payable July 1.
New York & Harlem, 4 per cent., payable July 1.
Oregon Railway & Navigation Co., quarterly 1¼ per cent., extra 1 per cent. payable July 1.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:
Oregon Railway & Navigation Co., annual meeting, Portland, Or., June 18.
Roanoke & Southern, annual meeting, Roanoke, Va., June 18.
St. Paul & Duluth, annual meeting, St. Paul, June 17.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Society of Civil Engineers* holds its annual convention at the Octagon House, Seabright, N. J., beginning June 20.

The *American Railway Master Mechanics' Association* will hold its next annual convention at Niagara Falls, beginning Tuesday, June 18, with headquarters at the International Hotel. All who wish to secure rooms should apply to Mr. A. H. Gluck, Manager, International Hotel, Niagara Falls, N. Y.

The *Master Car-Builders' Association* will hold its next annual convention at Saratoga Springs, N. Y., June 25. Hotel accommodations may be secured by applying to H. S. Clement, Manager Congress Hall.

The *International Association of Car Accountants* will hold its fourteenth annual meeting at Plank's Grand Hotel, Island of Mackinac, Mich., June 25.

The *Traveling Passenger Agents' Association* will hold its next meeting in Plank's Hotel, Mackinac Island, Mich., July 9.

The *Association of American Railway Accounting Officers* will hold its next meeting at Niagara Falls, N. Y., July 10.

The *National Association of General Baggage Agents* will hold its next meeting at Detroit, Mich., July 17.

The *New England Roadmasters' Association* will hold its next meeting in Boston, August 21.

The *Roadmasters' Association of America* will hold its seventh annual convention at Denver, Colo., Sept. 10.

The *American Association of General Passenger and Ticket Agents* will hold its next semi-annual meeting in Atlanta, Ga., Sept. 17.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month, except June, July and August. The next meeting will be held Sept. 11.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at its rooms in the Phenix Building, Jackson street, Chicago, at 2 p. m.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, at 7:30 p. m., on the third Thursday in each month.

The *Central Railway Club* meets at the Tift House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds its regular meeting on the first and third Wednesday in each month at the House of the Society 127 East Twenty-third street New York.

The *Boston Society of Civil Engineers* holds its regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 67 Washington street, Chicago, at 7:30 p. m., on the first Tuesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in St. Louis on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the house of the Club, 1,122 Gerard street, Philadelphia.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Penn Building, Pittsburgh, Pa.

The *Engineers' Club of Kansas City* meets at Kansas City, Mo., on the first Monday in each month.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Club of Kansas* holds regular meetings on the first Wednesday in each month at Wichita, Kan.

Engineers' Club of Philadelphia.

Regular meeting, June 1, 1889. Vice-President Arthur Beardsley in the chair; 15 members and 3 visitors present. Mr. R. Moade Bache read an illustrated paper, by Mr. Neville B. Craig, on the Vernier Telemeter. Mr. W. A. Morse, visitor, presented an illustrated description of the Smith Feed-water Heater and Purifier. There was some discussion by Mr. S. S. Evans.

Engineers' Society of Western Pennsylvania.

A regular meeting was held May 21 at the rooms of the Society, President Brashear in the chair, 30 members and 5 visitors present. Mr. Louis J. Clarke read a paper on the Phonograph and Graphophone. He gave in a very succinct way the history of the development of the phonograph. The reading of the paper was followed by a brief discussion.

Montana Society of Civil Engineers.

A regular meeting was held May 18, President Greene in the chair, 10 members and several visitors present. A communication from Mr. George H. Robinson was read discussing a law recently enacted by the Montana Legislature for the regulation and management of steam boilers and steam engines. The law creates the office of territorial boiler inspector, and provides for a test of boilers by hydrostatic pressure. Mr. Robinson pointed out the objections to hydrostatic tests, and said that hammer tests with outside and inside inspection of the general condition is the only method recognized now by boiler insurance companies as giving reliable information. The communication was discussed and referred to a committee of five for report at the July meeting. Mr. Beckler read a paper by Colonel Dodge on ancient Roman masonry, being a recital of his observations during a

recent visit in Rome. The paper was very interesting, and gave rise to an extended discussion upon masonry in general.

The Master Car-Builders' Association.

The Secretary has issued the following circular: The Annual Convention of the Master Car Builders' Association will be held at Congress Hall, Saratoga, N. Y., commencing on Tuesday, June 25, at 10 a. m. The By-laws provide that the revision of the Rules of Inter-change shall be the special order of business at 10 a. m., on the second day of the Convention (Wednesday). Members who have questions to propose for discussion at 12 noon, as provided by the By-laws, should send such questions to the Secretary in advance of the meeting, so that they may be published at the meeting, and a clearer discussion had.

PERSONAL.

—Mr. George D. Lawrence, recently Superintendent of the Chattanooga, Rome & Columbus, has been appointed General Manager of the Rome & Decatur.

—Mr. J. K. Hogan, New England Passenger Agent of the Queen & Crescent route, has tendered his resignation, and it is probable that the position will be abolished.

—Mr. John W. Kelly, Roadmaster of the Pittsburgh & Western, from Pittsburgh to Akron, has resigned to accept the appointment of Assistant Engineer of the Pittsburgh & Lake Erie.

—Mrs. Charles F. Adams, widow of the late C. F. Adams, and mother of John Quincy Adams and Chas. F. Adams, President of the Union Pacific, died in Quincy, Mass., June 7, aged 81 years.

—Mr. William Dawson, President of the Railway Lighting & Heating Co. since its organization, has resigned that position, and sails on the "Bothnia" June 19, for a long and well-earned vacation.

—Mr. E. L. Cortbell has established a New York office with Mr. A. P. Boller, at 73 Broadway. The partnership recently existing between Mr. Cortbell and Mr. George S. Morison has been dissolved.

—Mr. J. W. Sherwood, Superintendent of Transportation of the Chesapeake & Ohio, has resigned. Mr. Sherwood was for many years Superintendent of the Cincinnati, Indianapolis, St. Louis & Chicago road.

—Mr. Walter M. Anthony, formerly Auditor and General Ticket Agent of the Boston, Barre & Gardner road at Worcester, Mass., has entered the service of the Western States Passenger Association's rate and statistical department, under Chairman Abbott.

—The office of H. S. Rich, as Chairman of the Colorado Association, has been abolished by reason of the Trans-Missouri Association taking the place of the old association. Mr. Rich continues as Chairman of the Western Colorado and Southwestern Colorado associations.

—Mr. Wm. W. Wilson, who for nearly ten years has been Superintendent of Machinery for the Chicago & Alton, has resigned, owing to poor health. Mr. Wilson was for some time General Master Mechanic of the Chicago, Burlington & Quincy, and has also served in several responsible positions in the mechanical departments of other Western roads.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe Railroad Company in Chicago.—The board of directors elected at the annual meeting in Chicago is as follows: D. J. Chase, S. B. French, Charles E. Towne, John E. DeWitt, D. L. Gallup, Norman Williams, George C. Magoun, B. P. Cheney, Thomas Baring, William B. Strong, Henry W. Bishop, Arthur F. Towne, John J. McCook. President, William B. Strong; Vice President, Sanford B. French; Secretary, Charles S. Sweet; Treasurer, D. L. Gallup; Assistant Treasurer, C. S. Tuckerman; General Solicitor, George R. Peck; Comptroller, J. P. Whitehead; General Auditor, Joseph W. Reinhart; Auditor, C. S. Sutton; Manager, J. F. Goddard; Chief Engineer, A. A. Robinson.

Atlantic & Danville.—W. H. Pettibone, in addition to his duties as Assistant General Manager, will act as Purchasing Agent, vice Mr. Hungerford, resigned.

Baltimore & Drum Point.—The annual meeting of the stockholders of the road was held last week at 10 South street, Baltimore. The following directors were re-elected: Augustus Albert, Andrew Banks, James S. Hagerty, William H. Trego, A. E. Booth and Dr. H. H. Biedler, of Baltimore, Md.; Thomas S. Iglehart and J. Henry Selman, of Davidsonville, Md.; Thompson M. King, Obligation, Md.; John T. Bond and Thomas Farran, Jr., St. Leonard's, Md.; Alexander de Barri, Drum Point, Md. The Board of Directors afterwards elected officers as follows: President, Augustus Albert; Vice-President, William H. Trego; Treasurer, Andrew Banks; Secretary, H. A. Albert; Chief Engineer, Nicholas Goldsborough.

Baltimore & Ohio.—For the present, the position of General Ticket Agent, held by the late L. M. Cole, will be filled by Jas. M. Schryver, Assistant General Ticket Agent.

Baltimore & Potomac.—The stockholders of the company at their annual meeting elected the following officers and directors for the ensuing year: Oden Bowie, President; Frank Thomson, Vice President; John S. Leib, Treasurer; James P. Kerr, Secretary; Frank Thomson, George Small, W. T. Walters, B. F. Newcomer, E. J. Henkle, Samuel Cox, Jr., and R. D. Barclay, directors.

Belt Railway of Chicago.—The company has elected the following directors: O. S. Lyford, Chicago & Eastern Illinois; Charles M. Hayes, Wabash, St. Louis & Pacific; W. J. Spicer, Chicago & Grand Trunk; W. O. Johnson, Chicago & Atlantic; John B. Carson, Louisville, New Albany & Chicago Railway, Chicago, Ill.

Boston & Maine.—The General Manager announces the following changes of officers: George W. Storer, Assistant General Passenger Agent, having resigned, the office has been abolished. W. R. Brackett, heretofore General Baggage Agent of the Lowell system, has been appointed General Baggage Agent of the Boston & Maine and leased lines. A. S. Sturtevant has been appointed Chief Baggage Master of the Western Division. George Lane has been appointed Chief Baggage Master of the Eastern and Northern Divisions.

Boston & New York Air Line.—The company has elected the following directors: Henry B. Hammond, S. S. Sands, T. L. Watson, New York; S. F. Loomer, Williamatic; Simeon E. Baldwin, E. H. Trowbridge, George H. Watrous, New Haven; Theo. Adams, Philadelphia; William D. Bishop, Bridgeport; J. N. Camp and Benjamin Douglas, Middletown. The directors elected the following officers: President, H. B. Hammond, New York; Secretary, Thomas L. Watson, New York; Treasurer, William L. Squires, New Haven.

Chesapeake & Ohio.—Chas. H. Newell has just received the appointment of General Advertising Agent of the system, with headquarters at Cincinnati.

Chicago, Milwaukee & St. Paul.—J. W. Stapleton has been appointed Superintendent of the James River division, to succeed E. W. Hadley.

Chicago & Northwestern.—At the annual meeting in Chicago last week, the following were elected directors for three years: Horace Williams, Fred L. Ames, John M. Burke, Marvin Hughitt and N. K. Fairbank. The total vote cast was 376,068 out of a possible vote of 539,025. The only change in the board was the election of Frederick L. Ames, of Boston, to succeed D. O. Mills, of New York, resigned. The following officers were elected: Albert Keep, Chairman of the Board; Marvin Hughitt, President; M. L. Sykes, Vice-President, Secretary and Treasurer; J. B. Redfield, Assistant Secretary and Assistant Treasurer; S. O. Howe, Assistant Secretary and Assistant Treasurer in New York.

Chicago, Rock Island & Pacific.—The board of directors have appointed James R. Coving, Assistant Treasurer and Assistant Secretary in New York, J. F. Phillips Assistant Treasurer and Assistant Secretary in Chicago, and C. F. Jilson Assistant Treasurer in Toledo, Kan.

Chicago, St. Paul, Minneapolis & Omaha.—The shareholders of the company met at Hudson, Wis., June 8. Albert Keep, Cornelius Vanderbilt, W. K. Vanderbilt and H. McK. Twombly were elected directors for a term of three years. All of the old officers were re-elected.

Chicago, Santa Fe & California.—The following directors were elected at the meeting in Chicago this week: Charles L. Hutchinson, Edson Keith, William B. Strong, J. B. Morrison, Sidney A. Kent, Nelson Morris, William J. Watson, Oliver W. Peabody, B. P. Cheney, Abram Poole, George C. Magoun, John J. McCook, Norman Williams. President, William B. Strong; Second Vice-President and Chief Engineer, A. A. Robinson; Third Vice-President and Manager, J. F. Goddard; Secretary, Charles S. Sweet; Assistant Secretary, C. S. Tuckerman; Treasurer, D. L. Gallup; Assistant Treasurer, G. L. Goodwin; General Solicitor, George R. Peck; Comptroller, J. P. Whitehead; General Auditor, Joseph W. Reinhart; Auditor, Charles S. Sutton.

Chicago & Western Indiana.—The following were elected directors of the road at the meeting of stockholders in Chicago last week: O. S. Lyford, Chicago & Eastern Illinois; Charles M. Hayes, Wabash, St. Louis & Pacific; W. J. Spicer, Chicago & Grand Trunk; W. O. Johnson, Chicago & Atlantic; John B. Carson, Louisville, New Albany & Chicago; J. F. Goddard, Chicago, Santa Fe & California. Officers were elected as follows: President, John B. Carson; Vice-President and General Manager, B. Thomas; General Solicitor, C. M. Osborn; Secretary and Auditor, M. J. Clark; Treasurer, John E. Murphy.

Cincinnati & West Virginia.—The incorporators of this Ohio company are: William Brockil and Henry C. Gibson, of Pennsylvania; Henry Lewis, Thomas T. Goff, Samuel Hunt, Thomas D. Rhoades and Howard C. Hollister, of Cincinnati, and George West, of New York.

Cornington & Macon.—The following officers have been recently elected: John E. Jones, President, Macon, Ga.; John C. Key, Vice-President, Macon, Ga.; A. Craig Palmer, Secretary and Assistant Treasurer; A. J. McElroy, Superintendent, Chauncey N. Palmer, Auditor; N. E. Harris, General Counsel.

Delaware & Hudson Canal Co.—J. M. Zeigler has been appointed Assistant Superintendent in charge of the Adirondack Division (the Adirondack road recently purchased).

Des Moines & Fort Dodge.—The following directors have been chosen: Thomas Wright John Given, George W. Cobb, C. V. Gilmore, A. R. Flower, W. D. Purdy, A. Kimball, J. N. Dewey and H. N. Hollister. President, C. N. Gilmore; Vice-President, A. R. Flower; Treasurer, W. G. Purdy; Assistant Treasurer, O. T. Love.

Duluth & Iron Range.—The annual meeting was held in Duluth, June 11. The only change was the election of M. J. Carpenter as Vice-President and Director in place of R. H. Lee, and D. H. Bacon Director in place of Samuel P. Ely.

Evansville, Fort Wayne & Chicago.—The following are now the directors of this Indiana company: Milton Shirk, R. A. Edwards, G. R. Chamberlain, A. N. Dukes, Peru; T. J. Immel, and C. B. Knowlton, Logansport; Henry Jamison, Indianapolis.

Fremont, Elkhorn & Missouri Valley.—The following officers were elected last week: Marvin Hughitt, President; Albert Keep, Vice-President; M. M. Kirkman, Treasurer; J. B. Redfield, Secretary; John B. Hawley, Assistant Secretary; J. E. Ainsworth, Chief Engineer.

Kentucky Midland.—Vernon L. Clarke, has been appointed Traffic Manager with headquarters at Frankfort, Ky.

Kentucky Union.—The office of Superintendent has been abolished. R. T. Macdonald has been appointed Chief Engineer, vice W. A. Gunn, resigned. W. F. Packard has been appointed Master of Transportation. T. S. Slade has been appointed Roadmaster. The general office is at Lexington, Ky.

Louisville, New Albany & Chicago.—James Barker has been appointed General Passenger Agent, with headquarters at Chicago, in place of E. O. McCormick, resigned.

McKeesport & Belle Vernon.—James Ritchie, Principal Assistant Engineer of the New York, Pennsylvania & Ohio, has resigned to accept the position of General Superintendent of this road, with office in Pittsburgh.

Milwaukee, Lake Shore & Western.—At the annual meeting of the stockholders the following new directors were elected: Samuel S. Sand and Charles Dana, of New York; Theodore M. Davis, of Newport, R. I.; Joseph Vilas, of Manitowoc, and James H. Mead, of Sheboygan.

Monterey & Mexican Gulf.—A. J. Robertson, Assistant General Manager, has been chosen General Manager, to succeed T. R. Bullock, who resigns.

Mount Jewett, Kinzua & Rittville.—The following officers of this Pennsylvania company have been elected. Elisha K. Kane, President, Kane, Pa.; T. M. McClellan, Superintendent, Mt. Jewett, Pa.; Arthur Browne, Secretary and Auditor, Kane, Pa.; T. L. Kane, Treasurer, Kane, Pa.

New York & New England.—J. A. Shinn, Auditor, has resigned to become General Freight Agent of the road. He will be succeeded as Auditor by H. Dudley.

Northern Pacific Express.—E. W. Farnham has been appointed General Superintendent. After July 1 the company will do the express business on the Wisconsin Central road.

Ohio & Mississippi.—C. Kelly having resigned the office of Car Accountant, F. D. Farrington has been appointed his successor, with office in Cincinnati.

Ohio Valley.—At the recent annual meeting of the stockholders in Henderson, Ky., the old board was unanimously re-elected as follows: S. S. Brown, Pittsburgh; W. H. Tillinghast, Herman Clark and C. C. Baldwin, New York; P. G. Kelsey, Henderson; Arthur Carey and Jordan Giles, Louisville. The present officials will be re-elected.

Oregon Railway & Navigation Co.—Charles H. Gaylord has been appointed Supply Agent of this company, vice Edward Hoyt, resigned. His headquarters will be at Portland, Oregon.

Philadelphia, Wilmington & Baltimore.—D. S. Newhall has been chosen Assistant Secretary of this road, with office in Philadelphia.

Pittsburgh & Lake Erie.—John W. Kelly has been appointed Assistant Engineer, with office in Pittsburgh, Pa.

Poughkeepsie & Connecticut.—George C. Thayer has been appointed Assistant Superintendent of the Poughkeepsie & Connecticut, Poughkeepsie Bridge Co. and Hudson connecting road.

Queen Anne & Kent County.—Governor B. T. Biggs, of Delaware, has been elected President of the road.

Ravenswood, Spencer & Glenville.—The officers are: W. Woodward, President; J. A. McIntosh, Vice-President; D. W. Chapman, Secretary; C. C. Smith, Treasurer, and J. G. Shilling, Attorney.

Rome & Decatur.—George D. Lawrence has been appointed General Manager of this road, with office at Rome, Ga.

St. Louis, Arkansas & Texas.—The company announces that, in addition to his duties as General Land and Immigration Agent, J. St. Koslowsky will hereafter have charge of tax matters of this company, with title of Land and Tax Commissioner, having his office at St. Louis, Mo.

Selma & Bessemer.—The incorporators of this Alabama road are: Harvey L. McKee, Elbert F. Starr, Laurence H. Montgomery, Hugh A. Haralson, Joseph N. Stillwell, Alexander W. Cawthorn, Richardson M. Nelson, Hugh S. D. Mallory, all of Selma, Ala.

Shore Line.—The officers of this New Brunswick company formerly the Grand Southern, are: Richard J. Cross, President; W. Lamb, Manager; Hugh McLean, Secretary. Offices at St. George, N. B.

Sioux City, North Platte & Denver.—The President of this company is Loran Clark, and the Secretary is F. M. Sackett, of Albion, Neb.

Sullivan County.—The following have been elected directors of the road: A. B. Harris, of New York; H. C. Robinson, of Hartford, Conn.; Frederick Billings, of Woodstock, Vt.; C. J. Amidon, of Hinsdale; J. H. Albion, of Concord; N. E. Martin, of Concord; J. H. Williams, of Bellows Falls, Vt. A. B. Harris has been elected President, J. H. Albion, Clerk, and E. F. Lane, of Keene, Treasurer.

Sundusky, Ashland & Coshocton.—The officers of this company are: President, G. Clinton Gardner, Sandusky, Ohio; Vice-President, James Woolworth, Sandusky, Ohio; Treasurer and Assistant Secretary, J. O. Crane, New York; Secretary and Auditor, George A. Walter, Sandusky, Ohio; Engineer in Chief, pro tem., Felix Freyhold; General Counsel, John Mackey, Sandusky, Ohio.

Texas & Pacific.—W. F. Kantz has assumed the duties of General Eastern Agent with headquarters at No. 391 Broadway, New York. Henry A. Rich, New England Agent, 306 Washington street, Boston, will have charge of territory east of the state of New York.

Toledo, St. Louis & Kansas City.—The stockholders of the road held their annual election of directors in Toledo, June 12. W. H. Gilder and F. L. Russ, of New York, were elected in the place of H. K. Boardman, of Boston, and Isaac W. White, of New York. The old directors re-elected were: James M. Quigley, Joseph S. Stout, Clinton Sweet, Robert G. Ingersoll, John C. Havemeyer, New York; Samuel R. Callaway, Clarence Brown, Toledo; Henry A. Neal, William R. Patton, Charleston; Charles F. Tag, Hoboken, N. J.; and Samuel K. Wilson, Trenton, N. J.

Union Pacific.—D. M. Collins has been appointed Freight and Passenger Agent of the Union Pacific, with headquarters at Sioux City, Ia.

Whitefield & Jefferson.—At the adjourned annual meeting of the company the following directors were elected: A. L. Brown and W. G. Brown, of Whitefield; N. R. Perkins, of Jefferson; Ossian Rav, of Lancaster; Frederick Smyth, of Manchester; J. H. Pearson, of Concord; B. A. Kimball, of Concord, and H. N. Turner, of St. Johnsbury. The board organized with N. R. Perkins President, and H. M. Davis, of Concord, Clerk.

Winona & Southwestern.—The company held its meeting in Winona, June 5, and elected V. Simpson Director in place of Jno. S. Blaire. Directors for three years, C. Horton, A. Hamilton, W. H. Laird, T. Simpson. Officers were re-elected, Wm. Windom, President; H. W. Lamberton, Vice-President; M. G. Norton, Treasurer; Thos. Simpson, Secretary; D. M. Wheeler, Superintendent and Chief Engineer.

Wisconsin Central.—Assistant General Passenger Agent Louis Eckstein has been placed in charge of the General Passenger and Ticket Departments of the road until a successor is appointed to James Barker, recently resigned.

Wyoming Central.—Officers were elected this week as follows: Marvin Hughitt, President; Albert Keep, Vice-President; M. M. Kirkman, Treasurer; J. B. Redfield, Secretary; H. G. Burt, Superintendent.

OLD AND NEW ROADS.

Baltimore & Delaware Bay.—The grading on the extension from Nicholson to Tolchester, Md., is now nearly all done, and bids for tracklaying are invited. The work so far on the extension has been done by the company, and was not let to contractors. The Central of New Jersey recently sold its interest in the road to E. Thielens, of 121 Chestnut street, Philadelphia. Frank L. Hall, of 119 Liberty street, New York, is President.

Baltimore & Potomac.—The annual report gives the following as the statement of expenses and earnings for the past year: Gross earnings, \$1,539,126; increase, \$91,795, or 6.34 per cent.; expenses, \$1,029,565; increase, \$121,188, or 13.34 per cent.; net earnings, \$509,561; decrease, \$29,394, or 5.45 per cent.

Belleville & St. Louis.—Contracts have been let for grading this road from Belleville to East St. Louis, about eight miles. Track-laying will probably be begun in October and the road will be opened in December. J. S. Hill, of East St. Louis, is President, and Louis Graner, of Belleville, is Chief Engineer.

Birmingham Mineral.—The roadbed from Birmingham to Boyles, Ala., 32 miles, has been graded, and is now ready for the double track. The work of grading the south end from Birmingham to Grace's will commence soon. Work on the Red Mountain branch is also being hurried with a large force of hands at work on it.

Brazos & Northern.—Preliminary surveys have been completed and final location begun. It is expected that trains will be running between Velasco and Houston, Tex., next autumn.

Brockville, Westport & Sault Ste. Marie.—The section from Lyn, Ont., to Brockville has now been finished, completing the line from Brockville to Westport, 45 miles. The surveys have been made from Westport to Palmer Rapids, Ont., a distance of 75 miles, and the company intends to put this line under contract shortly. R. G. Harvey, of Brockville, Ont., is General Manager.

Cape Fear & Yadkin Valley.—Tracklaying on the extension from Fayetteville to Wilmington, N. C., 81 miles, is now in progress from the Wilmington end under J. M. Wright, who has the contract for tracklaying. The grading on the entire extension will be completed early in August.

Central Washington.—This line will be built to Davisine, W. T., 40 miles west of Davenport, W. T., instead of to Wilbur, as the property owners at the latter place would not give a sufficient land bonus.

Chicago, Rock Island & Pacific.—The annual report for the year ending April 1 shows that the gross earnings of the lines east of the Missouri River were \$12,841,029; operating expenses and taxes, \$9,127,198; net earnings, \$3,713,831. The gross earnings of the lines west of the Missouri River were \$4,721,476; operating expenses, \$4,038,978; net earnings, \$682,498. Total net earnings of the entire system, \$4,396,329. Cash receipts from lands sold, interest, etc., \$1,660,930. Total net income, \$6,057,259. From this amount has been paid: For interest on bonded debt, \$2,282,209; rentals of leased lines, \$1,865,733; rentals and tolls Missouri River bridges, \$226,141; dividends on capital stock, 5% per cent., \$2,653,824; premium paid for \$90,000 five per cent. extension bonds, purchased for account of the sinking fund under the mortgage, \$3,585. Total expenditures, \$7,031,493. Deficit for the year, \$974,234.

Chicago & West Michigan.—The directors issued a circular June 11 offering the right to stockholders to subscribe to \$1,000,000 of the securities of the company to complete a 75-mile extension of the line from Baldwin to Travers City, Mich.

Cincinnati & West Virginia.—Articles of incorporation filed in Ohio to build a road from Portsmouth to a point in Gallia County, opposite Point Pleasant, W. Va., virtually an extension of the Ohio & Northwestern. The capital stock is \$100,000.

Cleveland, Cincinnati, Chicago & St. Louis.—Articles of incorporation have been filed in Ohio, consolidating the "Bee Line" and "Big Four" roads. The capital stock of the consolidated company is \$30,500,000. The new company assumes all liabilities; \$20,500,000 of the shares to be common stock, and \$10,000,000 preferred stock. Five per cent. of the net earnings is to be paid quarterly to holders of preferred stock and the residue to the common stock. For each share of the present capital of the Big Four, one share of preferred stock and 30 per cent. of one share of the common stock of the consolidated company is to be issued at the rate of \$113.33 1/3 for \$100 stock of the Bee Line. The entire stock of the Indianapolis & St. Louis to be reissued in proportion to the holdings at the rate of 3 1/2 in the stock of the consolidated for each share of the "Bee Line."

Coshocton & Southern.—Tracklaying on this extension of the Cleveland & Canton has been completed to Zanesville, from Coshocton, and the entire 30 miles will be open for traffic this week.

Covington & Macon.—Work on the branch from Machen to Griffin, Ga., has been suspended and the force discharged.

Craig Mineral.—McCarthy & Ross have been given the contract for grading 10 miles of this road. The line has now been located from Eagle Rock to Newcastle, Va., 25 miles, and it is expected to have this section completed by next January.

Denver, Texas & Fort Worth.—A branch has been built this year from Forbes Junction, Col., to Victor Junction, five miles. From that point to Victor mines, two miles, a line has been built by the Cañon de Agua road. J. R. De Remer, of Denver, Col., was the contractor for both sides.

Duluth & Iron Range.—At the annual meeting in Duluth this week it was voted that the surplus for the year, \$1,300,000, be used at the discretion of the Executive Committee for the improvement of the property. It is thought that this means the building by the company of a line of vessels to carry its ore to the Eastern markets.

Evansville & Richmond.—Grading on the road has been completed to within a short distance of where the road crosses the Jeffersonville, Madison & Indianapolis, at Seymour, Ind.

Galveston & Western.—It is stated that at a stockholders' meeting to be held in Galveston next Tuesday, definite action will be taken concerning the construction of the line from Galveston to a point on the Texas-Mexican branch of the Mexican National at Collins, Tex., 60 miles east of Laredo, and giving Galveston direct connection with the City of Mexico. It is thought that the Mexican National will give substantial help to secure the building of the road.

Grand Southern.—This New Brunswick road, heretofore known as the Grand Southern, is now known as the Shore Line Railway Co.

Iiwaco & Shoalwater Bay.—The narrow gauge road from Iiwaco, W. T., to Baker's Bay has been completed to Naratta, on Shoalwater Bay, a distance of 16 miles. It runs the whole distance along the shore in sight of the breakers and through a succession of resorts frequented by seaside visitors during the summer.

Kanawha.—C. D. Langhorne, of Richmond, has been awarded the contract for building a nine-mile extension from Fairfield, Va., and he has already put a force on the work.

Kansas City, Watkins & Gulf.—Kennedy & Stone, of Topeka Kan., have been given the contract for building 50 miles of this road, which has been surveyed from Lake Charles, La., north to Shreveport, 180 miles. J. B. Watkins, of Lawrence, Kan., is President.

Kansas City, Wyandotte & Northwestern.—The Chief Engineer has just put a party of engineers, under Mr. Baxter L. Burns, into Nebraska, to locate the line for the extension of this road from Summerfield, Kan., the present terminus, northwest to Beatrice, Neb., 36 miles. The probabilities are that it will be placed under contract as soon as located. The Chief Engineer also has a party under Mr. Arthur L. Young running lines around and into Kansas

City, Mo., with a view of getting better terminal facilities. Nothing definite has yet been done in regard to the Kansas City, Lawrence & Wichita. The new shops in Wyandotte, Kan., will be completed this month.

Kentucky Union.—Track has been laid this year from Winchester to Kentucky Union Junction, six miles, and from Clay City up Red River and its Middle Fork, 15 miles. Work is in progress from Lexington, east to Winchester, 25 miles, and from the end of the track southeast to Jackson, in Breathitt County. The distance from Lexington to Jackson is 93 miles, and it is expected to have the road completed between these points this year.

Lampasas, Burnet & Southwestern.—The engineer corps of the road has completed the survey from Lampasas to Burnet, Tex., and to a point on the Austin & Northwestern, about five miles north of Burnet. A route, about 23 miles in length, was found to each point, the latter being the less costly to build.

Louisville & Nashville.—About 1,500 men were last week put to work on the Short Line division between Louisville and Cincinnati, straightening and shortening the line. Many trestles will be filled in and many not so treated will be replaced with iron structures. The company proposes to shorten the distance by eight or ten miles.

Louisville, New Orleans & Texas.—The extension of the Lake Washington branch from Hampton, its present terminus, to Rolling Fork on the main line, 11 miles, has been let to Robt. Johnson, of Memphis, Tenn. The grading is being pushed from each end and it is expected to have the extension in operation by the middle of July.

Macon & Birmingham.—The survey has reached Culloden, Ga., from Macon, and will be continued via Thomaston and La Grange to Birmingham, Ala., about 220 miles.

Marietta & North Georgia.—This road was made standard gauge last week from Marietta north to Blue Ridge, Ga., 87 miles. The extension from Blue Ridge to Murphy, N. C., 25 miles, is also standard gauge. The Knoxville Southern, the extension to Knoxville, will soon be finished. As soon as the charter is obtained work on the extension from Marietta to Atlanta will be commenced. The road bed is newly graded, has been straightened very much, and all the bridges are of iron, resting upon marble substructure.

Mary Lee Coal & Iron Co.—This Birmingham company has awarded the contract for building its six mile railroad to Dunn Bros. & Co., of Birmingham.

Mexican Central.—On the Tampico Division rails are laid from a connection with the main line, a little north of Aguascalientes, eastward to the city of San Luis Potosi, a distance of 131 miles, and from the Gulf of Mexico westward 119 miles, making a total of 250 miles completed. The length of the division is about 407 miles, and there is still about 158 miles to build, for which the contracts have all been let, and the grading on the eastern end is well advanced. The principal contractors are: J. H. Hampson, of Kansas City, Mo.; Price, McGavock & Co., of Pueblo, Col.; and Brinkman & Turnbull, of the City of Mexico. It is expected that the line will be finished by Jan. 1 next.

Midland & Pacific.—Press dispatches from Pierre, Dak., state that a surveying party has started to survey a railroad of this name through to the Pacific Coast, probably touching at Minnesella in the Black Hills, making Pierre the initial point on the Missouri. Work on the survey is to last some five months.

Milwaukee, Lake Shore & Western.—The company has filed notice with the Secretary of State of Wisconsin of its intention to construct a branch from the main line, near the village of Anewa, Shawano County, to a point in the same county 12 miles distant.

The Ontonagon River branch has been opened for business from Watersmeet, Mich., northward to Interior, a distance of 10 miles.

Mississippi Valley.—The Southwestern International Co. has been organized to build this road from West Baton Rouge, La. to Arkansas City, Ark., 290 miles. Hiram R. Steele, of Vidalia, is President.

Nashville, Chattanooga & St. Louis.—The par value of stock is to be raised from \$25 to \$100. The Legislature of Tennessee recently granted permission to make the change, and the directors have voted to exchange the stock on or about July 1 next. The total amount of stock is \$6,668,531.

Nashville & Tellico.—The sale of this road has been ordered to satisfy a judgment of \$140,000 obtained by McDonald, Shea & Co., of Knoxville, Tenn., the contractors who constructed the line from Athens to Tellico, Tenn., 24 miles, and whose claim for the work the company was unable to satisfy.

New Orleans, Fort Jackson & Grand Isle.—Piereson & Moylan, of New Orleans, have secured the contract for building 20 miles of this road. The rest of the line will be built under the immediate direction of the company. Preliminary surveys have been made from Algiers, opposite New Orleans, south to Fort Jackson, 65 miles. The locating surveys are now in progress. It is proposed to build to Grand Isle, 20 miles south of Fort Jackson in the future. Right of way to Fort Jackson and considerable local aid has been secured. H. C. Warmoth, of New Orleans, is President and Charles S. Dwight, of 25 Carondelet street, is Chief Engineer.

New Roads.—A movement is on foot to form a company in Blount County, Ala., for the purpose of building a railroad from Bangor, on the Louisville & Nashville, to Blountville, the county seat. The road will be 12 miles in length. The Louisville & Nashville has offered to operate the line if it is built.

New Westminster Southern.—A camp of workmen has been established just at the international boundary line. The road is now ready for the rails from Brownsville, seven miles south of New Westminster, B. C.

New York, Ontario & Western.—The company has awarded the contract for building the "zig-zag" tunnel through the mountain divide between the waters of the Delaware and Susquehanna rivers, seven miles north of Walton, Delaware County, N. Y., to the firm of Ward & Leary, of Newburg, N. Y. The tunnel will be 1,600 ft. long, 160 ft. below the highest point of the mountain, with approaches 2,000 ft. long on each side. The work will be begun at once and completed in a year. The tunnel is to supersede the famous zig-zag or series of reverse curves, which now carries the track of the road up the steep eastern slope of the mountain.

The work will reduce the maximum grade at that point from 104 to 75 ft., shorten the line by two miles and reduce the time of passenger trains by about 15 minutes. The cost to the company of the entire improvement is estimated at \$600,000.

Northern Pacific.—Press dispatches state that the company will build from West Minnewaukan, Dak., the

present terminus of the Jamestown & Northern branch, to Leeds, 18 miles distant. The survey is complete, and bids for the grading advertised for.

Mathews Bros. & Kerrick, of Minneapolis, have taken the contract for bridging and tracklaying on the Gallatin & Butte branch, 72 miles, from Gallatin to Butte, Mont. About 8,000,000 ft. of timber will be required for bridges on this line of road.

Northern Pacific & Manitoba.—The following is a corrected list of the contractors on the first 50 miles of the Morris and Brandon Branch: Egan Brothers, 15 miles; Mann Brothers, 10 miles; J. G. Dennison, 5 miles; Irwin & McAnany, 5 miles; McArthur & McRay, 15 miles, all of Winnipeg, Man. The contracts for the balance will probably be let within the next thirty days.

Nova Scotia Central.—Tracklaying is in progress on this road, which is being built across Nova Scotia from a connection with the Windsor & Annapolis at Middleton to Lunenburg on the south, a distance of 73 miles. The grading is all completed, and about 35 miles of track has been laid. There are four iron bridges on the line and several viaducts. There are no wooden trestles, considerable filling in having been done at various points where they might have been built. There are 15 stations. An extension of 9 miles from Middleton, north to the Bay of Fundy is contemplated. George W. Bedford, 265 Broadway, New York, is the contractor, and is also Secretary of the company. The government gives a cash subsidy of \$696,000, a land subsidy of 150,000 acres, and right of way and station grounds. No bonds have yet been issued, but it is proposed to issue \$740,000 6 per cents on the road and land grant.

Oregon Railway Extension Co.—The company has filed a mortgage made to the Farmers' Loan & Trust Co., of New York, to cover the following prospective roads: From a point on the Oregon Railway Navigation Co.'s line, near Alto, through Eureka Flat, to Walla Walla; another from near Estes, across the flat to Grange City, and thence effect a junction with the Oregon Railway & Navigation line. A road from Portland to Astoria, is also named.

Oregon Railway & Navigation Co.—It is understood that an agreement has been made between the Presidents of the Union Pacific and Northern Pacific that will secure a unanimous vote for directors of this company to be named jointly by Henry Villard and Gen. G. M. Dodge in Portland, Ore., the stock held by the Oregon Transcontinental Co. being voted for these directors. All litigation in the New York courts affecting this company is to be discontinued, and the Union Pacific is to continue its guaranty of 6 per cent. dividends on Oregon Railway & Navigation stock. The lease, however, is to be amended so as to permit the expenditure of certain sums for additional equipment and other purposes. Both officers will endeavor to bring about the consummation of a trackage agreement for the common use of the company's tracks east of the Cascade Mountains, and this company is to be given better connection with Puget Sound over the Northern Pacific tracks. Mr. Adams and Mr. Oakes also agree to recommend an early sale of the holdings of the Oregon Navigation stock now held by the Oregon Transcontinental Co. The special fund now in the treasury of the Oregon Navigation Co. shall be used by the incoming board of directors for the benefit of the property, and so as to relieve the Oregon Short Line from the burden of the unmodified lease, so far as can legally and properly be done.

Orlando & Winter Park.—This road has been opened for business from Orlando, Fla., northward to Osceola, a distance of six miles.

Pontiac, Oxford & Port Austin.—This road, which extends from Pontiac to Caseville, Mich., 100 miles, was sold at Pontiac, June 6, at mortgage sale and was purchased for \$600,000 by a representative of the bondholders. The section of country through which the road runs was devastated several years ago by forest fires, and has not since been prosperous.

Raymond.—Incorporated in West Virginia to build a road from a point on the Pocataligo River, in Putnam County, W. Va., to Spencer, Roane County, a distance of about 40 miles. Among the incorporators are H. M. Smith, W. H. Gould and E. Schonebaum. The principal offices will be at Cincinnati, Ohio.

Redondo.—It is expected to have this short California road, from Los Angeles to Redondo Beach, completed and in operation by July 15. The Los Angeles Construction Co. is grading the road, and the Laclede Car Co., of St. Louis, is building the cars. The locomotives are of the "motor" style, very light, and are built by Louis Ransom, of Kansas City. George J. Ainsworth, of Los Angeles, is President.

Red River, Sabine & Western.—The engineers have completed a preliminary survey for the line from New Birmingham, westerly to Palestine, Tex.

St. Louis, Alton & Springfield.—A mortgage for \$300,000 has been filed in the office of the Secretary of State of Illinois in favor of the Farmers' Loan & Trust Co., of New York, for the purpose of completing an independent line into the city of Springfield, Ill., from the terminus of the main line at Bates, a distance of 13 miles.

St. Louis & Chicago.—In the United States Court at Springfield, Ill., on June 7, Judge Gresham handed down his decree in the proceedings brought for the foreclosure of four separate mortgages. The American Loan & Trust Co., of New York, takes the southern ten miles, from Litchfield to Mount Olyte. The \$1,000,000 mortgage held by the Mercantile Trust Co. against the northern 45 miles was also allowed. The order of priority as fixed by the decree as applied to the northern 45 miles, from Springfield to Litchfield, gives Wade & Hopkins first lien, Mercantile Trust Co. second and American Loan & Trust Co. third. As to the southern 10 miles, the Wade & Hopkins interest get first lien and the American Loan & Trust Co. the second. The road will remain in the hands of the present receiver until the sale can take place in accordance with the terms of the decree.

Sandusky, Ashland & Coshocton.—The contract of Keating Bros. & Co., of Pittsburgh, Pa., is for the first 72 miles. This section has been surveyed, and it is asserted that all financial arrangements for its construction have been completed. The route proposed is from Sandusky southeast to Coshocton, O., 120 miles, with a branch, the Walbonding & Mohawk road, 26 miles long, which is to be built into the canal coal fields of Bedford and Jefferson townships in Coshocton County. It is also proposed to extend this latter line to the Ohio River. This company has acquired extensive holdings of real estate and water front in the city of Sandusky, affording room for extensive accommodations for grain and ore traffic. The city of Sandusky has donated for the improvement of wharves and landings of the East Battery Terminal Co., which is connected with this company, the sum of \$200,000 in 50-year 4 per cent. bonds. The capital stock is \$6,000,000, with \$5,000,000 five per cent. bonds, which are for the purpose of improving the terminal property, as well as for the construction of the road. The Wal-

bonding & Mohawk has a capital stock of \$1,500,000, and a bonded indebtedness of \$500,000.

San Gabriel Valley Rapid Transit.—Tracklaying has been nearly completed on the Pasadena branch from Ramona to Pasadena, Cal. Monroe & Armstrong, of Monrovia, have the contract for tracklaying.

Savannah, Dublin & Western.—This road was offered for sale at Savannah, Ga., June 4, the upset price fixed by the Court being \$50,000. No bid was made, and the Receiver then obtained from the Superior Court an order directing the sale of the road on July 2, for cash, without reserve. There is no minimum price, the sale being subject to the confirmation of the Court.

Seattle, Lake Shore & Eastern.—On the Northern branch, which is contemplated to extend this year, from the end of the present track, six miles north of Snohomish, W. T., to the British boundary, some 80 miles, the location from the boundary south to the Skagit River is now being made by two parties; one under Edwin Hall Warner from the boundary south; the other under M. Stixrud from the Skagit River north. The location between Snohomish and the Skagit River was practically completed last season. On the Snoqualmie branch two miles of track from Falls City, east, had been laid May 29, and tracklaying will progress till the ten miles of Smith & Burns' contract from Falls City, east, is completed. This will probably take till July 15. The grading is completed, but bridges delay the work somewhat, and ballasting has to be done.

Seattle & Southern.—The surveyors of this line have passed to the south of Chehalis, Wash. Ter., and are encamped on Newankum Prairie.

Selma & Bessemer.—This company has been organized in Alabama to build a road from Selma to Birmingham, through the counties of Dallas, Perry, Bibb and Jefferson.

Shepaug, Litchfield & Northern.—The Connecticut House has passed the bill authorizing this company to consolidate with the company that proposes to build the new road from Hawleyville to Saugatuck, Conn.

Silverton.—Tracklaying on this road has now been finished to Ironton, Col., a distance of 20 miles from Silverton. Nearly all this line was completed last year, the work being suspended in the fall on account of the snow and the long trestle that had to be erected. Extensions to Eureka, 10 miles, and Ouray, 12 miles, are to be built.

Sioux City, North Platte & Denver.—The survey for this road is to commence within 10 days. It is projected to extend from Decatur, Neb., on the Missouri River via Albia and North Platte to Denver, Col.

Southern Pacific.—The gross earnings for the year ending Dec. 31, 1888, were the largest in the company's history, footing up \$46,699,615, as against \$37,930,161 for the previous year, an increase of over 20 per cent. The expenses were \$30,708,676, having increased 31.77 per cent., so that the net gained but 8.66 per cent. The mileage operated has increased from 5,512 average for the previous year to 5,789, or 4.46 per cent. The principal lines worked are the three Southern Pacific roads of California, Arizona and New Mexico, all of which show a profit after meeting fixed charges. Next in importance are the lines in Louisiana and Texas, known as the Atlantic System, all of which show a profit to the lessee, except the link between Houston and El Paso, which, being a new line, worked at a disadvantage, with costly fuel, and shows a slight deficit. The Central Pacific, which is leased on a fixed minimum rental, earned \$15,838,832, and yielded its interest and fixed charges, but fell short by \$397,170 of the dividends which the rental is made to equal. The Northern Railway of California is one of the most profitable of the leased properties, yielding sufficient to meet all charges and a 6 per cent. dividend to the stock as consolidated. Besides the net earnings from lease operations, which amounted to \$15,176,585, the other income from investments, etc., was \$2,149,770, all of which had been expended (for interest on bonded debt \$9,030,830, rentals, sinking funds, etc.), except \$2,109,371, profit for the year, which, added to the surplus of the previous year, \$1,399,757, leaves a total balance in favor of the Southern Pacific of \$2,609,159. There is a slight increase in the floating debt.

The Northern California road and the Marysville steamboats were transferred to the Southern Pacific Co. June 1.

Southern Vermont.—Governor Ames sent a message to the Massachusetts Senate, June 6, which was referred to the Railroad Committee, recommending that the Council be authorized to sell the Southern Vermont road to the Fitchburg and to settle all claims in controversy between the Commonwealth and the Fitchburg and Troy & Boston corporations. The Southern Vermont is a short section of the main line of the Fitchburg extending across the southwest corner of the state of Vermont. The rental paid by the Fitchburg is \$4,933 yearly.

Sulphur Springs & Red River.—A preliminary survey has been made from Sulphur Springs north to Cooper, Tex., and it will soon be continued to the Red River. Several more lines will be run; the surveyors are now finishing some difficult locating near Sulphur Springs.

Texas Roads.—Several months ago the Attorney General of Texas began suit in the court against the Southern Pacific and other state lines for the return to the state of 15,000,000 acres of land which had been given to the railroads on certain conditions. These conditions the state asserted were violated and the forfeiture of the lands was demanded. Judge Key has decided in favor of the state. A great portion of the lands have passed into other hands, having been sold by the railroads, and under the decision the supposed owners have no titles. The decision of course applies only to lands in the state of Texas.

Upper Coos.—The New Hampshire Legislature is to be asked to authorize the construction of a railroad from North Stratford to the vicinity of Scotts' in Lancaster, for the purpose of connecting the Upper Coos road with the Portland & Ogdensburg.

Utah Central.—A directors' meeting has been called for July 11, to be held in Salt Lake City, to consider the consolidation of the Utah Central, the Utah & Northern, the Oregon Short line, the Salt Lake & Western, the Utah & Nevada, the Ogden & Syracuse, the Idaho Central and the Nevada Pacific into one corporation, having one board of directors. The meeting is merely formal. The stockholders have already voted in favor of the consolidation.

Washington & Idaho.—Work on this line between Spokane Falls and Rockford, Wash., connecting the former with the Oregon Railway & Navigation and the Union Pacific lines, will begin at once, it has been officially announced. Kilpatrick Bros. & Collins have the contract.

Yankton, Norfolk & Southwestern.—The survey for this road has just been completed, and the company expects to let the contracts for building the line on July 10. It is to extend from Yankton, Dak., to Norfolk, Neb., about 60 miles. J. T. M. Pierce, of Yankton, is Secretary.

TRAFFIC.

Traffic Notes.

The Chicago & Alton has notified Chairman Walker, of the Inter-state Commerce Railway Association, that, in accordance with the rules of the association, it will on June 14 reduce the rate on lumber from Chicago to Missouri River points, notwithstanding the recent decision of the board of arbitration. The exact rate is not named, but the right is reserved to make it as low as 10 cents. Certain Chicago lumber dealers have already quoted prices in Kansas City which are said to be possible only in case a large reduction in the freight rate is made.

The competitors of the Union Pacific having complained that the road secured an undue share of the traffic in bullion from Utah and Colorado to the Missouri River, the matter was referred to the Executive Board of the Inter-state Commerce Railway Association for arbitration. The Board rendered its decision June 7, authorizing the proposed reduction from \$15 to \$13 a ton in the rate on bullion from Utah common points to the Missouri River, but refusing to authorize any change in the existing rate of \$7 a ton from Denver and other Colorado points.

A Chicago paper of Wednesday says: "The contemplated lake and rail route from Chicago to Montreal, by way of Lake Michigan to St. Ignace and thence eastward over the Canadian Pacific, has fallen through. The hitch came in making the lake connections. The Canadian Pacific was not willing to pay the Lake Michigan & Lake Superior Transportation Co. and the Northern Michigan line the proportion on through business asked by them. The Canadian Pacific was figuring on making its export rate from Chicago to Montreal the same as that offered by the Union Steamboat Co. to Philadelphia. Inasmuch as the latter company carries flour from Chicago to Buffalo for about 4 cents per 100 lbs., it was thought that the two lake lines mentioned in the scheme would be willing to carry flour to St. Ignace at an equal rate. This proved to be a mistake. Both lines have a good paying local business that could not be sacrificed for anything the Canadian Pacific showed a disposition to offer."

Kansas City Live Stock.

The following is the decision of the Board of Arbitration of the Inter-state Commerce Railway Association on the recent complaint of the Chicago & Alton.

The undersigned, having considered the application of the Chicago & Alton, heard June 5, 1889, in respect to the competitive live-stock traffic from Southwestern Missouri River points; the provisions of Article 17 of the agreement under which application is made undoubtedly contemplated that the entire competitive traffic in the territory in question shall be considered; portions or classes of such business are to be taken up in view of their relation to or effect upon the aggregate traffic. This course has been pursued in arriving at the result reached by the Executive Board in the present case. It is found that the Chicago, Milwaukee & St. Paul during the current year has obtained a proportion of the live stock traffic from Kansas City largely in excess of the share which it should receive in order to effect an equitable distribution. The methods by which this result has been reached are not important for the present purposes. The principles by which this association is governed require that the Chicago, Milwaukee & St. Paul restrict its live stock traffic to an amount not exceeding two train loads per week until the inequality is corrected, of which notice will be given. For the present all other lines will remain open to shippers without change in rates or in facilities. So far as the diversion can be properly controlled the benefit thereof should be given for the time being to the Chicago & Alton. It is not considered necessary at present to indicate the method to be adopted for this purpose. In case, however, results are not at once apparent or the course taken is found to be disadvantageous to other interests it may become necessary to advance the rate upon such line or lines as receive an unreasonable proportion of the traffic, and the right is reserved to make that recommendation or to propose any other arrangement adapted to accomplish the result above indicated. The matter is also held open for further consideration in respect to other lines should occasion arise. The Executive Board recommends immediate consideration by managers of the question of establishing a joint agency for the handling of the traffic in question. It believes that this method will put an end to favoritism and discrimination among shippers, will greatly reduce expense of receiving and transporting the freight, will act as a check upon all kinds of irregularity and controversy, and will be in various ways a great advantage to both shippers and railroads. It therefore suggests the appointment of a committee to take up the matter in conjunction with the Executive Board for the purpose of formulating a definite arrangement to that effect."

Railroad Accommodations for Colored People.

The Supreme Court of Mississippi, in the case of the Louisville, New Orleans & Texas against the state, decided that the statutes requiring roads to provide separate but like accommodations for the black and the white races is constitutional, and sustained the verdict of the lower court, wherein damages for \$250 were awarded against the road in two cases.

East-bound Shipments.

The shipments of east-bound freight from Chicago by all lines for the week ending June 8 amounted to 45,191 tons, against 38,409 tons during the preceding week, an increase of 6,782 tons, and against 34,790 tons during the corresponding week of 1888, an increase of 10,401 tons. The proportions carried by each road were as follows:

	W'k to June 8.		W'k to June 1.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central.....	4,796	10.6	4,113	10.7
Wabash.....	4,702	10.4	3,951	10.3
Lake Shore & Michigan South.	7,755	17.1	5,734	15.0
Pitts., Ft. Wayne & Chicago.	4,290	9.5	5,334	15.9
Chicago, St. Louis & Pitts.....	5,333	11.8	4,724	12.4
Baltimore & Ohio.....	3,498	6.9	2,315	6.1
Chicago & Grand Trunk.....	9,718	14.1	5,898	15.2
New York, Chic. & St. Louis.....	3,541	7.8	2,090	5.3
Chicago & Atlantic.....	5,328	11.8	4,290	11.1
Total.....	45,191	100.0	38,409	100.0

Of the above shipments 1,992 tons were flour, 10,163 tons grain, 2,135 tons millstuff, 5,903 tons cured meats, 1,945 tons lard, 10,937 tons dressed beef, 166 tons grass seed, 2,547 tons butter, 926 tons hides, 359 tons wool, and 6,638 tons lumber. The three Vanderbilt lines carried 35.5 per cent. of all the shipments, while the two Pennsylvania lines carried but 21.3 per cent.